The

Journal of Heredity

(Formerly the American Breeders' Magazine)

Vol. XI, No. 1 January, 1920

CONTENTS

Heritable Characters of Maize—Lineate Leaves, by G. N. Collins and J. H. Kempton 3

Heredity and Economical Production of Food, by D. S. Burch 7

Note on the Origin of Piebald Spotting in Dogs, by C. C. Little 12

Teas' Hybrid Catalpa, by D. F. Jones and W. O. Filley 16

Some Promising New Pear Stocks, by Beverly T. Galloway 25

The Decline of Autocracy and Its Relation to Warfare, by Frederick Adams Woods 33

The Spread of Rosen Rye, by Frank A. Spragg 42

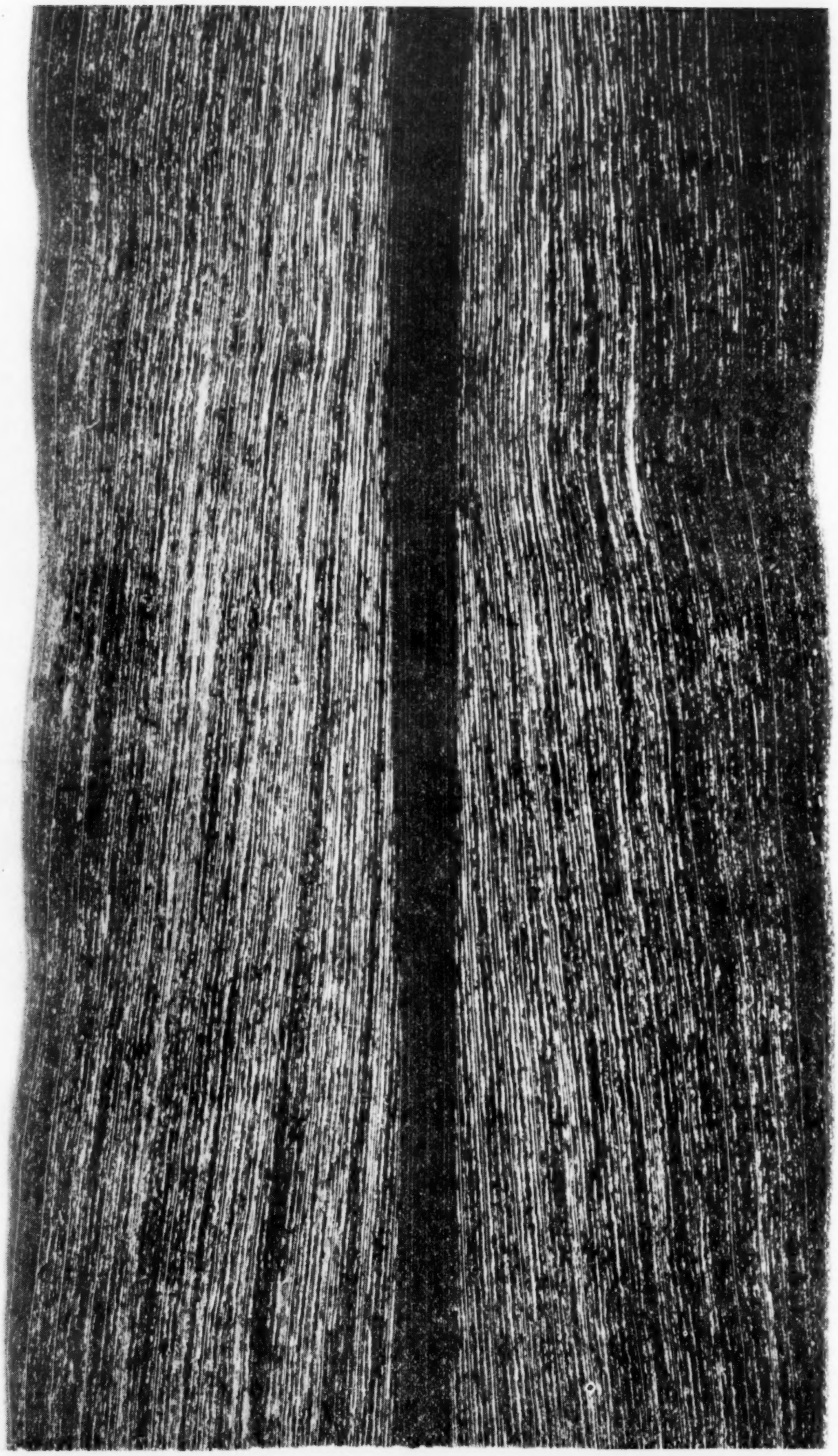
Pioneer Growers of the Dasheen 46

A New Dahlia of Interest to Plant Breeders 48

The Journal of Heredity is published monthly by the American Genetic Association (formerly called the American Breeders' Association) for the benefit of its members. Canadian members who desire to receive it should send 25 cents a year, in addition to their regular membership dues of $2, because of additional postage on the magazine; foreign members pay 50 cents extra for the same reason. Subscription price to non-members, $2.00 a year, foreign postage extra; price of single copies, 25 cents.

Entered as second-class matter February 24, 1915, at the postoffice at Washington, D. C., under the act of August 24, 1912. Contents copyrighted 1920 by the American Genetic Association. Reproduction of articles or parts of articles permitted provided proper credit is given to author and to the Journal of Heredity (Organ of the American Genetic Association), Washington, D. C.

Date of issue of this number, February 10, 1920.



A LINEATED MAIZE LEAF

This very fine white striping occurs in the uppermost leaves, usually beginning in about the tenth leaf from the seed. The stripes are "usually from 1/10 to 1/4 mm. in width and vary from a few millimeters to many in length." Being closely spaced, they give a grayish effect to the upper leaves, in contrast to the normal green of the lower ones. (Frontispiece).

HERITABLE CHARACTERS OF MAIZE

I. LINEATE LEAVES

Description and Classification of Lineate Plants—Value of Maize as Material for Investigation, and Economic Importance of Discovering Latent Variations

G. N. Collins and J. H. Kempton
Bureau of Plant Industry, Washington, D. C.

THE practice of withholding the description of new characters until their genetic behavior has been thoroughly investigated, though sometimes desirable, is leading to much unnecessary duplication of work, and is delaying the progress of knowledge of inheritance in maize. The present article is the first of a series in which it is planned to describe and illustrate the heritable variations of maize as they arise or are discovered.

In order to lessen as far as possible the number of places in which the new characters of this one species are published, and, with the idea of facilitating reference, it is proposed to inaugurate a numbered series. The liberal policy of the Journal of Heredity toward the use of illustrations makes it an especially suitable medium for the publication of short articles of this kind in which photographs play an important part. It was, furthermore, in *The American Breeders Magazine*, the precursor of the present journal, that a number of new characters of maize were first published by R. A. Emerson. It is to be hoped that other workers with maize will find this a convenient place in which to publish illustrations and brief descriptions of their discoveries.

Abnormalities in maize are of such frequent occurrence that it is of course impracticable and probably undesirable to attempt to describe individual variations. As soon, however, as it has been demonstrated that a character is inherited and a stock of seed capable of reproducing the character has been secured, it seems desirable to have the variations brought to the attention of other workers. Once attention has been directed to a variation it is less likely to be overlooked, and the instances where the same variation occurs in unrelated stocks are sooner recognized.

IMPORTANCE OF INVESTIGATIONS IN MAIZE

Our knowledge of the interrelation of Mendelian characters should proceed with increasing rapidity as the number of such characters increases. If the linear arrangement of characters in inheritance should be found to hold for maize as for Drosophila, the proper location of a new character becomes easier as the number of characters whose location is known increases.

Although a majority of the heritable differences in maize are of such a complex nature as to make Mendelian analysis difficult or impossible, alternative characters are coming to light in such numbers as to warrant the belief that maize will rival Drosophila as material for the investigation of the linear arrangement of factors and of chromosomes as the bearers of the determinats of characters. A knowledge of the variations latent in the commercial varieties of maize is furthermore of great economic importance, since most of the variant forms are less productive than the normal forms, and they must be recognized to be eliminated.

DESCRIPTION OF THE LINEATE PLANTS

The character here described, which is designated "lineate leaves," consists of a very fine striping on the blades of

the upper leaves. The lower leaves of plants possessing this character are normal, the striping first making its appearance on about the tenth leaf from the seed. From the tenth to the uppermost, the blades are marked with fine, narrow, nearly white stripes which are usually from 1/10 to 1/4 mm. in width and vary from a few millimeters to many centimeters in length. In pronounced cases the stripes are separated by not more than their width. The general effect of the closely spaced fine stripes is to give the blade a grayish appearance that contrasts sharply with the uniform green of normal leaves. (See frontispiece.)

Lineate plants first appeared, or at least were first observed, in four progenies of a hybrid sweet corn that was being grown at Lanham, Md., in 1918. The sweet corn in which the lineate plants occurred was a hybrid between Stowells' Evergreen and a prolific variety of field corn from Brownsville, Tex.[1]

The original cross was made in Texas in 1912. In 1913 the F_1 population was grown in an isolated block at Victoria, Tex. In 1914 an F_2 population was grown at Lanham, Md., and from the crossing of two plants the ear designated Ph124 was secured.

Plants from Ph124 were grown in Chula Vista, Cal., in 1915, and again in Lanham, Md., in 1916 when one cross-pollinated ear, Ph124LI, was secured. In 1917 seeds of Ph124 were again planted at Lanham, together with seeds of Ph124L1. From these plantings there were secured 16 cross-pollinated ears of Ph124, 31 cross-pollinated ears of Ph 124L1 and 8 crosses between Ph124 and Ph124L1.

In 1918 the 16 cross-pollinated ears of the Ph124 progeny and 3 of the crosses between Ph124 and Ph124L1 were planted. Lineate plants occurred in 3 of the 16 progenies of Ph124 and in one of the crosses between Ph124 and Ph124L1. The ratio of lineate to green plants is shown in Table I.

The ratios are all reasonably close to the monohybrid 3:1, and the results may be explained by assuming that one parent of Ph124 was heterozygous for lineate, a simple Mendelian character recessive to the normal green. If the lineate character was the result of a mutation in a single gamete this mutation must have occurred in 1913 in one of the grandparents of Ph124.

This follows from the fact that lineate plants have been confined to descendants of Ph124, that approximately one-fourth of the cross-pollinated progenies of Ph124 produced lineate plants (4 out of 19) and that in the progenies in which lineate appeared one-fourth of the plants exhibited this character.

Six hand-pollinated ears were secured from the progenies shown in Table I. One of these six ears represented a cross between a normal green female plant and a lineate male, one was the result of crossing two lineate plants, a

TABLE I.—*Showing the Number of Lineate and the Number of Green Plants in Four Progenies Grown from Hand-Pollinated Ears.*

Progeny designation	No. of green plants	No. of lineate plants	Expected 3:1	
Ph124L2	15	7	16.5	5.5
Ph124L3	20	11	23.3	7.7
Ph124L5	18	6	18.0	6.0
Ph124L10	24	8	24.0	8.0
Total	77	32	82	27

[1] The history of this cross is discussed in "Breeding Sweet Corn Resistant to the Corn Earworm," Collins, G. N., and Kempton, J. H., *Journ. Agri. Res.*, XI, No. 11, pp. 449–572, December 10, 1917.

third resulted from crossing two normal green plants, and the remaining three ears were the result of self-pollinating lineate plants.

DEGREE OF LINEATION VARIABLE

Seeds from all six ears were planted in 1919, and all of the progenies produced some lineate plants. The progenies, however, were not alike, and it was apparent that this character was extremely variable in expression. In classifying the plants an attempt was made to estimate the degree of lineation. A scale of ten grades was adopted, and although the classes were arbitrary it was found that independent observers were able to place the plants in essentially the same grades. The classification of the plants secured from the progenies of the six ears is shown in Table II.

With the exception of the two green plants, found in the progeny of a self-pollinated lineate plant, the results accord well with the expectation based on the assumption that lineate is a simple Mendelian character recessive to the normal form. The two green plants will be tested this coming season, and while it is within the realm of possibility that they are in reality lineate, the fact that they occurred in the progeny which exhibited the most intense expression of lineation is an argument against this explanation.

RESULTS FROM RELATED PROGENIES

In addition to the six ears secured from progenies which produced lineate plants in 1918, there were twelve hand-pollinated ears from related progenies which produced no lineate plants in 1918. All of these ears are directly descended from the ear Ph124.

Seeds from the twelve ears were planted in 1919, and the progeny of five of these produced some lineated plants. The five progenies are shown in Table III.

TABLE II.—*Proportion of Green to Lineate Plants, the Average Degree of Lineation and the Average Leaf from the Seed on Which Lineations First Appeared.*

Designation of progeny	Female parent	Male parent	No. of green plants	No. of lineate plants	Degree of lineation	Aver. leaf on which lineations first appeared
Ph124L2L1	Lineate	Self	0	28	5.37 ± .20	10.7
Ph124L10L2	Lineate	Self	0	41	2.74 ± .28	11.8
Ph124L10L3	Lineate	Self	2	19	5.84 ± .14	9.3
Ph124L2L2	Green	Lineate	15	14	4.00 ± .49	10.2
Ph124L5L1	Lineate	Lineate	0	35	5.78 ± .28	9.5
Ph124L10L1	Green	Green	24	3	3.00 ± *	9.0

* Probable error not calculated, since only three plants are involved in this average.

TABLE III.—*Proportion of Green to Lineate Plants in the Progeny of Five Hand-pollinated Ears.*

Designation of progeny	Female parent	Male parent	No. of green	No. of lineate
Ph124L4L1	Green	Self	69	3
Ph124L12L1	Green	Self	18	7
Ph124L13L1	Green	Self	7	3
Ph124L20L1	Green	Self	16	9
Ph124L9L1	Green	Green	124	1

The fact that five of these twelve ears produced lineate plants, although the parental progenies were normal green, involves no genetic complexities. The progenies which produced these five ears were all the result of crossing sister plants, and it seems not unreasonable to assume that one parent in each combination was heterozygous for lineate and the other homozygous for normal green.

The ratio of green to lineate plants in three of the progenies shown in Table III is as close an approximation to the Mendelian monohybrid 3:1 as could be expected with the small numbers involved, but the remaining two progenies clearly do not conform.

It may well be that in these two aberrant progenies we are witnessing a recurrence of the mutation which will behave subsequently as a Mendelian unit character in full accord with the progenies just discussed. An alternative explanation lies in the wide variation in the expression of this character, indicating the influence of a number of modifying factors which may obscure the true nature of most of the lineate plants.

The variations in expression, however, are no larger than is found in most strains of japonica or similar stripe patterns. Japonica forms of striping similarly occur in aberrant ratios, several instances having appeared in our breeding blocks where one or two plants in several hundred exhibit white striping. The same progenies produce a few striped plants in successive plantings. This behavior has not interfered with analysis in progenies where the ratios are Mendelian and the segregation is sharp. There is, therefore, little reason why lineate leaves should not take their place with the other chlorophyll variations in maize affording another character with which to test the linear arrangement of factors.

The Heredity and Environment of a Great Botanist

The story of Joseph Hooker's lifework is, in one aspect, the history of the share taken by botany in establishing the theory of evolution and the effect produced upon it by acceptance of that theory. He began with unrivalled opportunities and made unrivalled use of them. As a botanist, he was born in the purple, for in the realm of botany his father, Sir William Hooker, was one of the chief princes, and he had at hand his father's splendid herbarium and the botanic garden which he had made one of the scientific glories of Glasgow University.

Joseph Hooker's earliest recollections are preserved in an autobiographical fragment, set down late in his life. Noteworthy among the events that emerge from childish forgetfulness, like hill-tops above a sea of mist, is the early love of nature, and especially of plants, inborn in him and indeed inherited from both lines of his parentage. His father and his mother's father were both botanists, and singularly enough they both began their studies as such with the mosses, quite independently of one another; so that, being confessedly "a born Muscologist," he playfully dubs himself "the puppet of Natural Selection."—From Life and Letters of Sir Joseph Dalton Hooker, by Leonard Huxley; in 2 vols. London: John Murray, 1918.

HEREDITY AND ECONOMICAL PRODUCTION OF FOOD

D. S. BURCH
Bureau of Animal Industry, U. S. Department of Agriculture

WITHIN the last century, evolution, used in a broad sense, has been unusually conspicuous in the field of mechanics and engineering. Just why that is true, while evolution among living creatures has progressed more slowly and has attracted less general attention, may be seen from a few well-known facts.

EDUCATION HAS FOSTERED ENGINEERING PROGRESS

Progress in any field, as a rule, is approximately in proportion to the amount of study given that field by persons of progressive thought and action. With the gradual development of the United States, engineering long ago became the life study of thousands. Opportunities were plentiful, and well-trained men were ready to take them. The examples and the successes of the first spurred others to similar training. The result attained was inevitable, and today the United States has not only great systems of railroads, irrigation projects, highways and mechanical industries, but in addition it has thousands of people who are expert in various branches of such work and can press on to still greater and wider engineering achievements.

Even in the rather specialized field of agricultural machinery we must remember that the progress made is due to the work of many minds. A few conspicuous names, it is true, loom up above the rest, but countless improvements and refinements rather than a few revolutionary ideas have contributed to the present advancement in labor-saving farm machinery.

I have in mind the experimental staff of a firm manufacturing farm tractors and implements Every fall the chief designer and one or more of his assistants pack their grips for a circuit of State fairs. Mingling with farmers at the machinery exhibits, these specialists seek for new ideas and suggestions. In addition they try to learn what new implements or machines would be likely to meet with favor.

Such efforts explain why American farmers are so well equipped with machinery that multiplies human labor in a way that has won the wonder of other nations. It explains also why with high-priced labor the United States can produce many kinds of food, especially grains, hay, and other bulky crops, so cheaply. But in the field of meat food products, so important to the vigor of a nation, our progress, though noteworthy, appears capable of extensive developments.

The drift of thought has been so gradual as to attract slight attention by persons interested especially in evolution in the organic sense. Yet the enormous preponderance of effort in mechanical development is seen in the enrollment of almost any college or university having a wide range in its curriculum. A graduating class in a middle western university a few years ago included 400 students. Approximately one-fourth were trained in engineering, while only sixteen—less than one-twentieth—were trained in agriculture, and only one of the sixteen had made a study of animal genetics. While such a striking ratio may not be typical today, especially in universities having strong agricultural courses, it indicates at least the subordinate place the study of genetics—from an agricultural angle—has occupied in the general field of education.

The study of heredity as it concerns the production of livestock in the United States has gone forward under the efforts and interest of competent and energetic investigators. There has been gratifying achievement. The champion dairy cow of today seldom retains her laurels, earned by a large yield, for more than a few years. Much the same is true in the show ring. In fact, with all stock, constant rivalry among breeders soon displaces the winners of one year with new champions. Yet in considering improvement in the average sense, we are forcibly reminded that the total number of exhibitors is rather small in proportion to the total number of livestock owners. In a similar way a few high records of production have earned world-wide attention. Such records are merely a few peaks in a statistical chart where the general average production is low.

The average yields of milk per dairy cow in fourteen prominent countries show that the United States is in the sixth place, being excelled by the Netherlands, Switzerland, Denmark, Germany, and Canada. Our ability to produce scores of cows which yield more than 20,000 pounds of milk a year is ample proof that our national production of less than 4,000 pounds per year per cow, in the last analysis, is a reflection of inattention and average lack of applied skill. The dairy cow is a good example—probably the best—because her production is so readily measured and because there is so much uniform evidence in various countries. Yet the same principle and similar facts apply to other lines of production.

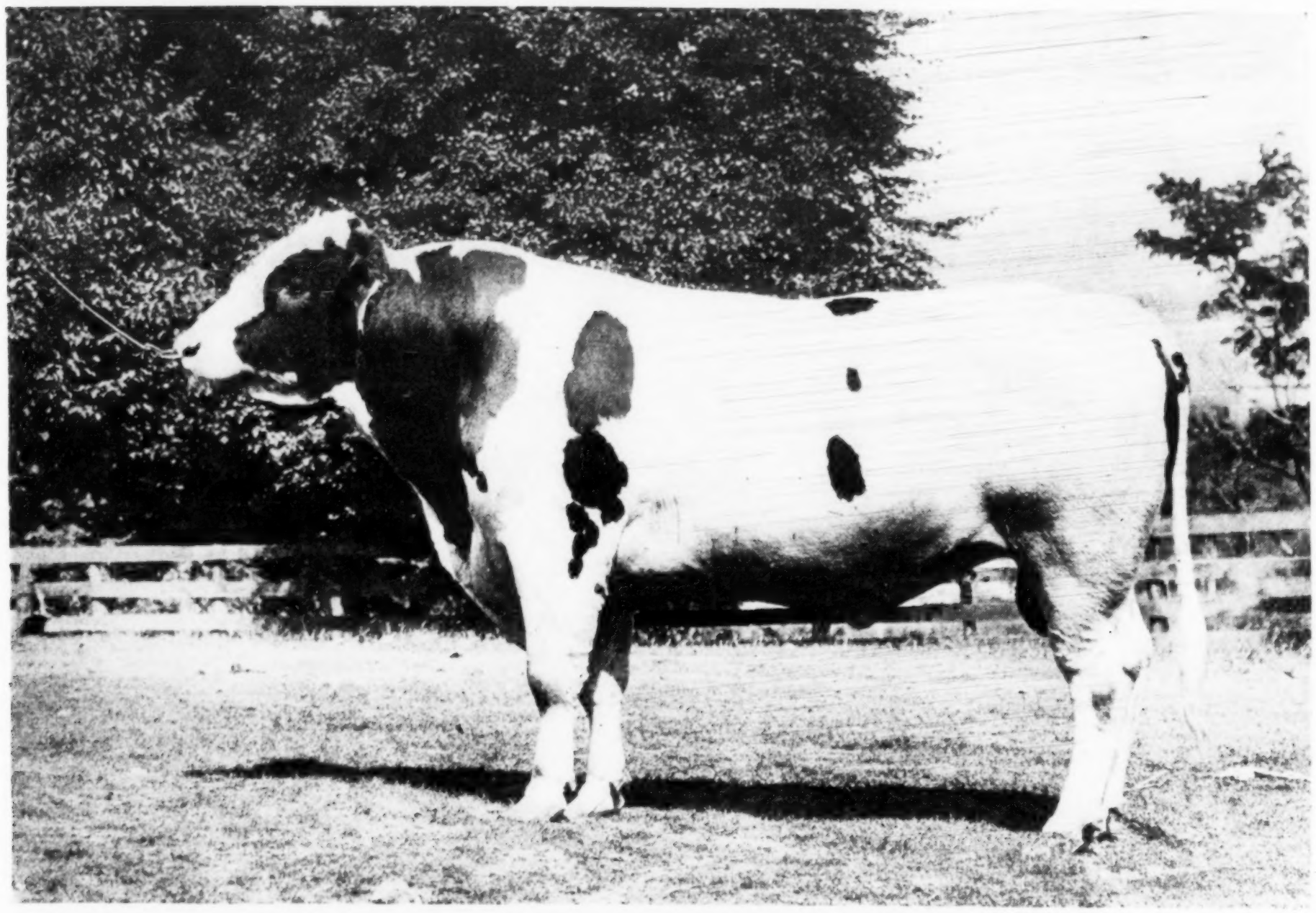
Even a superficial consideration of the facts mentioned points to the progress which livestock raisers in the United States would make if next year 1,000 persons began thinking intelligently about animal breeding for every one person who thought about it this year. That would bring about a condition whereby combined human effort in studying and applying laws of heredity to livestock breeding would approximate the effort being devoted to mechanical progress. It would help to attain in livestock evolution a great average advance without in any way interfering with success in producing individual world beaters.

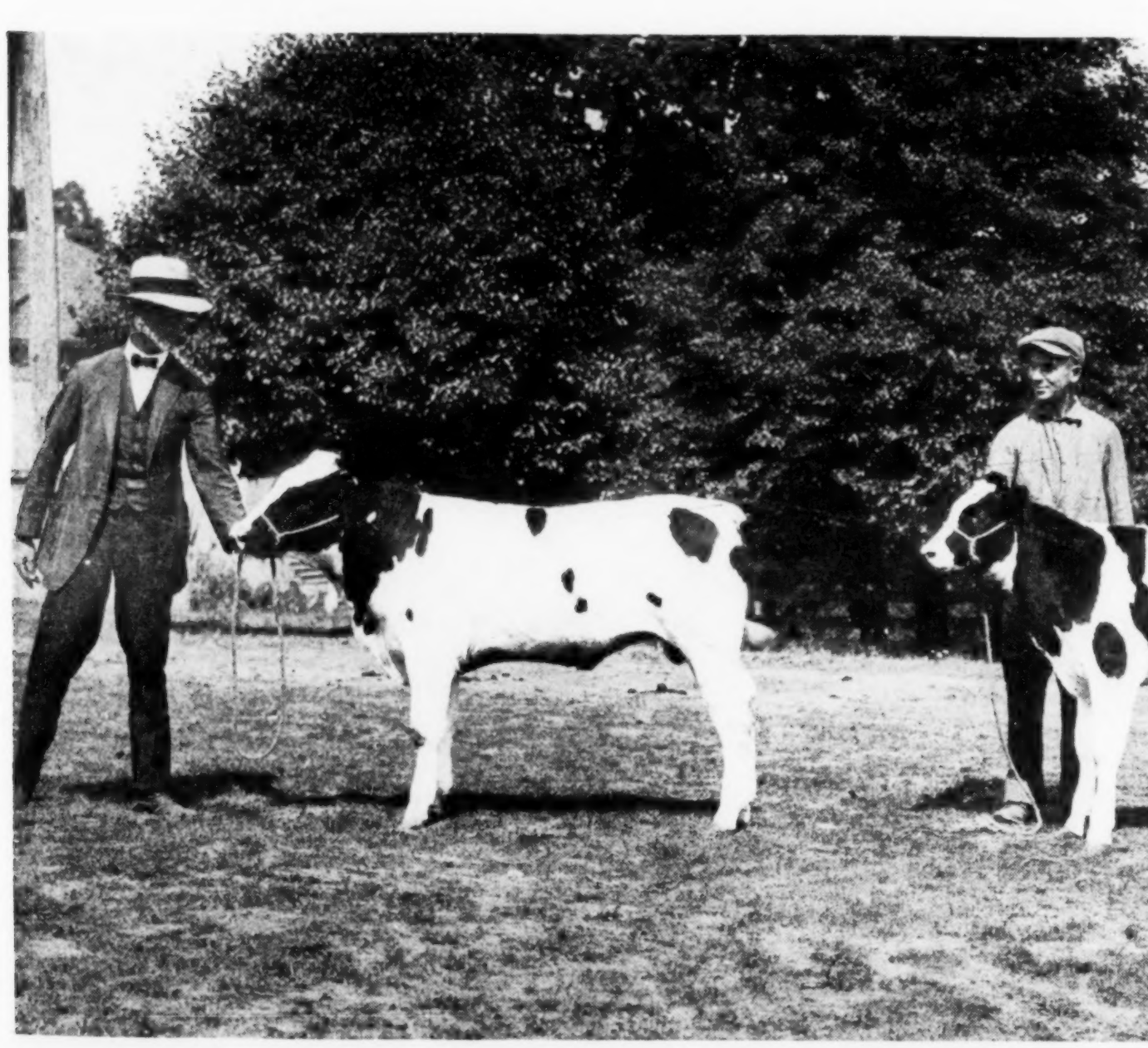
Without going into detail, the economical production of meat, dairy products, poultry products, and animal power is closely related to breeding. The well-bred steer is economical to raise because a relatively less proportion of feed goes into his maintenance and a greater proportion goes into his gain in weight. Besides, his quality is better and the period of growth to profitable market age is shorter. The same is true, with some qualifications, of swine, sheep, poultry, and most other stock. In short, skillful breeding results in numerous benefits, including economy of production, a quicker turnover of investment, progressive improvement of herds and flocks, and better meat food products for consumers.

TEACHING HEREDITY TO MANY

Notwithstanding the efforts of agricultural colleges and similar agencies in the United States, farmers are not as familiar with the basic laws of breeding as they are with the basic laws of mechanics. For every person who understands Mendel's law at least a score know the law of the lever. This comparison may seem odd because the law of the lever appears so much simpler, yet it is simpler chiefly because civilization has thought in mechanical terms. Man owned livestock long before he owned a wheeled cart. Bringing the comparison to modern times we may safely assert that 1,000 persons understand a carburetor for every one who knows a chromosome.

In the endeavor to stimulate interest in heredity and in the basic principles of breeding, the United States Department of Agriculture lately has directed attention to the use of pure-bred sires for all livestock. Of the various methods of animal improvement the principle of grading up through the use of pure-bred males is probably the most practical and economical. In June, 1919, the department proposed





A HOLSTEIN BULL AND CALVES SIRED BY HIM

An interesting study in conformation and coat color. Note particularly the head and neck of the bull calf at the left. America should be better equipped with animals such as these to meet the increasing needs of the coming years. "Skillful breeding results in numerous benefits, including economy of production, a quicker turnover of investment, progressive improvement of herds and flocks, and better meat food products for consumers." (Fig. 1.)

to the extension directors of the various states the desirability of conducting a nation-wide effort to induce livestock owners to replace scrub and grade sires with pure-breds. More than that, the desirability of improving the quality of pure-bred sires themselves was presented. In addition to consulting livestock experts of the agricultural colleges, the Federal Department of Agriculture presented a tentative plan of the proposed campaign to others also, including county agents, agricultural editors, officers of livestock associations, secretaries of boards of agriculture, livestock sanitary officials, prominent breeders, and others who might be interested. Of nearly 600 replies received, approximately 97% favored such a campaign without qualifications. Most of the remaining 3% made specific suggestions for modifications of the plan, and a few either were skeptical or presented adverse opinions. The cream of the suggestions, after careful consideration, was embodied in the original plan, which was also altered to meet various local conditions discussed in a number of the letters received. The revised plan of the campaign was presented in August and has met with practically unanimous approval. The agricultural press has devoted space freely to the support of the work, and 41 states already have made the campaign, popularly known as the "Better Sires-Better Stock" movement, a part of their extension activities. It was definitely inaugurated as a Federal-State enterprise on October 1, 1919. Since then more than 25,000 pieces of literature have been distributed to meet requests from the field. Two-thirds of this constituted enrollment blanks, which when properly filled out entitle the person using only pure-bred sires for all his livestock to official recognition by the United States Department of Agriculture and by the state in which he lives. The remaining one-third was miscellaneous literature, including a plan of the campaign, and also pointing out the policies under which the campaign is conducted.

As would be expected, the enrollment records of persons using pure-bred sires show that a majority of them likewise have some pure-bred female stock. A considerable amount of grade stock is noted, also some cross-breds. This condition is true in a broad sense of all the kinds of animals included in the campaign, namely, cattle, horses, asses, swine, sheep, goats, and poultry. The records show that users of pure-bred sires keep only a few scrub females, the remnant probably of the first foundation stock.

FARMERS' BULLETIN ON BREEDING PRINCIPLES

Reinforcing the Federal-State effort to encourage the use of better sires, Dr. Sewall Wright, of the Animal Husbandry Division of the Department of Agriculture, has prepared a manuscript on breeding principles for the Farmers' Bulletin series. This contribution is believed to fill an important gap in the agricultural literature of the United States, being of service not only to breeders directly but likewise to extension workers and others who address farmers' gatherings. The underlying thought in the better-sires movement is to create in the minds of thousands, and, if possible, millions, of livestock raisers an interest in the basic principles of animal breeding. The field of improvement in livestock is as vast as that of mechanics. It is believed also that thousands of farmers who have an inherent preference for working with living things rather than machinery will welcome the opportunity to replace their fragmentary and inaccurate knowledge of livestock breeding with the dependable information contained in the bulletin mentioned.

Thus heredity, in addition to being a study calling for keen effort by those who would solve its mysteries, becomes an effective agency when presented and explained to those who as owners of livestock are expected to supply the food needs of the country.

Members of the American Genetic Association may render wide public service by helping breeders assimilate and apply principles of heredity already known but not generally used.

A PRODUCT OF SELECT BREEDING

To develop a fine type of livestock is as noteworthy an achievement as to complete a fine piece of engineering. The animal pictured above has been produced only after careful selection and proper mating of ancestors. Successful breeders pay rigid attention to the laws of inheritance. The study of genetics, to make more widespread a knowledge of these laws, is worthy of more prominence in our educational institutions. What would be the effect on livestock raising in the United States "if next year 1,000 persons began thinking intelligently about animal breeding for every one person who thought about it this year? That would bring about a condition whereby combined human effort in studying and applying laws of heredity to livestock breeding would approximate the effort being devoted to mechanical progress." (Fig. 2.)

A NOTE ON THE ORIGIN OF PIEBALD SPOTTING IN DOGS

C. C. LITTLE
Carnegie Institution of Washington, Cold Spring Harbor, N. Y.

SEVERAL varieties of dogs such as foxhounds, beagles, Boston terriers, St. Bernards, and collies, are characterized by the possession of a piebald coat pattern. In this pattern, large and relatively regular, and definitely localized white spots occur on a colored ground. The extreme form of such spotting is seen in bull terriers. Here the entire skin and coat is commonly unpigmented, the eyes alone being colored. The appearance of exceptional individuals, however, in which small red or yellowish spots are found on the head, near the eyes or ears, shows that the pattern is really one of greatly reduced spotting and not of true albinism.

On the other extreme of the spotted series one finds, among breeds normally solid colored, certain animals in which one or more of the feet may be white, or which may possess a white spot or blaze on the chest. Data on Great Danes, collected from the American Kennel Club Stud Books indicate that such spots are hereditary and are due to a factor which is hypostatic to solid colored coat. (Little and Jones,[1] 1919.)

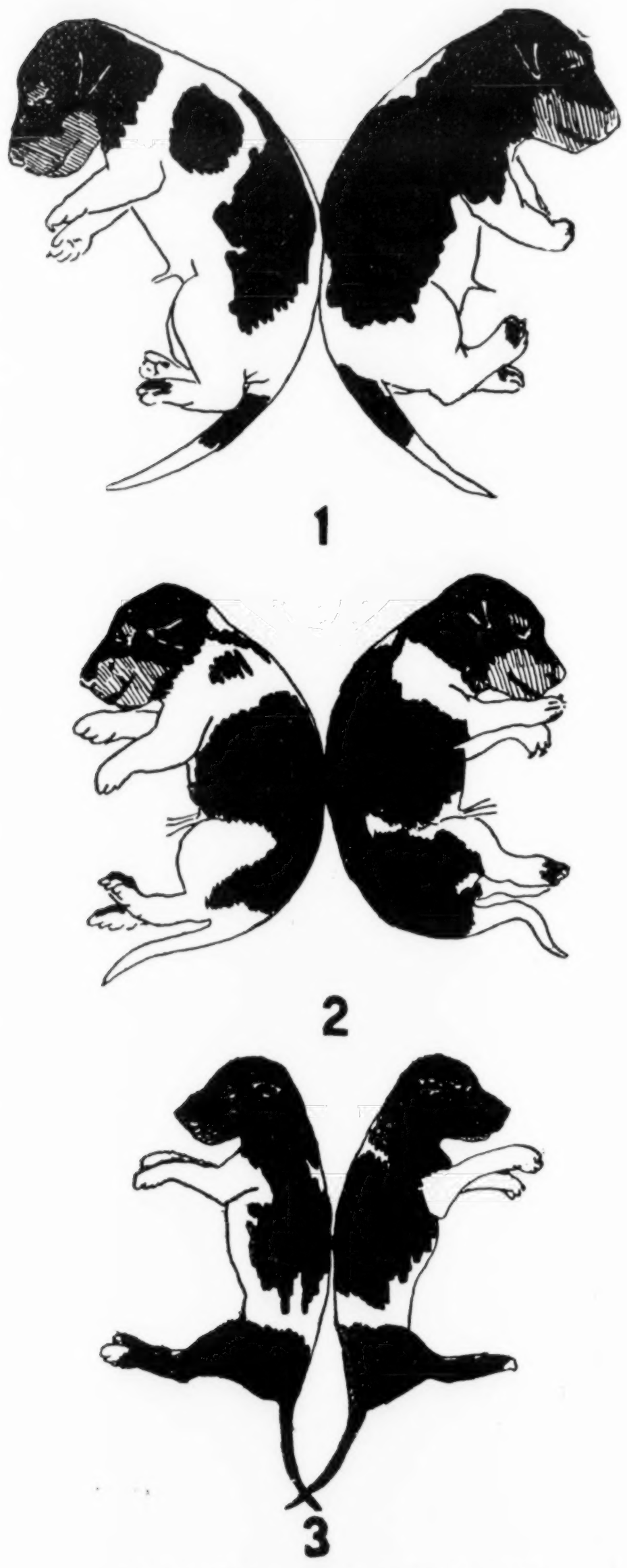
Such animals, which show a slight degree of white spotting, have, by some been considered as being forms from which, by rigid selection, spotted breeds have been developed. That this is also the case in rodents has been stated by Castle[2] (1916, page 125) as follows: ". . . Rarely does it (the degree of spotting) go beyond these slight and inconspicuous markings. But under artificial selection in captivity it is possible rapidly to increase the extent of the white areas in the coat, which then takes on striking and often rather definite outlines, as in Dutch marked rabbits, English rabbits, hooded rats, and black-eyed white mice. . . . The production of white-spotted races from small beginnings observed in wild stocks has been accomplished in the laboratory by Castle and Phillips in the case of Peromyscus, and by Little in the case of the house mouse (unpublished data)."

Inasmuch as the inference from the above is that the writer, among others, has by selection developed from a wild race of rodents with a small amount of spotting, a race of heavily spotted animals, it should be stated that progress from the original degree of spotting observed, in the wild mouse used, was made *only after a cross with a tame race and that following the cross progress was so rapid that the introduction of modifying factors by the unspotted race used undoubtedly had occurred.*

EVIDENCE THAT SPOTTING IN DOGS MAY OCCUR BY MUTATION

By this I do not mean to assert that some progress might not be made by selection alone within the race in which the spotting originated, but merely to point out that there is little or no experimental evidence that the "Dutch" or "English" rabbits or black-eyed white mice or hooded rats mentioned by Castle were developed by selection alone, within a wild race, showing a minute degree of spotting. It is possible that this is the case, and will remain so until their origin *de novo* is demonstrated and analyzed; but in the meantime it is interesting to review two cases in dogs which give direct evidence as to the origin of spotted individuals and which suggest that a spotted race

[1] Little, C. C., and Jones, E. E., JOURNAL OF HEREDITY, October, 1919, Vol. x, No. 7.
[2] Castle, W. E., "Genetics and Eugenics." Harvard University Press, Cambridge, Mass.



PIEBALD COAT PATTERNS

Coat patterns, such as these, characterize several varieties of dogs, but similar spotting is occasionally found among breeds that are normally solid colored. Study of these cases indicates that such spotting is hereditary. Nos. 1 and 2 above represent Airedale terriers, and No. 3 a Scottish terrier puppy. (Fig. 3.)

may arise from a self race, by mutation, without passing through a series of minute gradations directed by selection.

The first case to be reviewed is that of a spotted Scottish terrier puppy (Fig. 3, No. 3) born in my father's kennels, January 22, 1909. This puppy, a bitch, was the only individual born in the first litter obtained from two young solid-colored, pedigreed, and registered Scottish terriers, neither of which had been out of the kennels from the time at which they became sexually mature. The spotted puppy in question was born dead, a fact not very suprising in view of the litter being the first produced by the bitch. The two parents are far from closely related as a glance at the pedigree (Table I) will show. If the spotted coat of the exceptional puppy is hypostatic to solid colored coat, it may be considered as introduced by the germ cells of both parents either by parallel mutations occurring in each of them, or by being contributed to each of them by a common ancestor. If the idea of the occurrence of parallel mutations on each side of the pedigree is considered as far fetched, we must look on both sides of its pedigree for an ancestor or ancestors in common. In this connection, Balmacron Prince occurring in the fourth generation on the male side and in the third generation on the female side appears to be the only possibility. If this dog was, in respect to hypostatic piebald spotting, DR in formula, he might well have introduced this spotting into the cross. The result would have been that, after several generations, the proper DR x DR mating would have been made, and an RR or spotted individual would have resulted.

The fact of particular interest from the viewpoint of the origin of spotting is that the puppy had white areas of considerable extent and could in no way be considered a product of selection of minute variations possessed by lightly spotted ancestors.

The second case presents even more interesting features. It deals with the appearance of spotted individuals in two litters of Airedale terriers. The

TABLE I.—*Pedigree of Spotted Scottish Terrier Puppy (Fig. 3, No. 3)*

(Sire) Newcastle Carom	Clan Bonnacord Jock	Seafield Rascal	Seafield	
			Seafield Nora	
		Bonnacord Jewel	Camowen Laddie	
			Glenhin Beauty	
	Nosegay Cornflower	Nosegay Crimson Rambler	Balmacron Thistle	Balmacron Prince
				Balmacron Tib
			Baberton Lass	Balmacron Prince
				Lauriston Lass
		Valdora Gem	Roxburgh	
			Loyne Ginger	
(Dam) Newcastle Confidence	Brynhir Barber	Undercliffe Sandy	Cairn Dhu	
			Corrie Linnhe	
		Foula	Kildee	
			Zelta	
	Morachi	Baberton Prince	Balmacron Prince	
			Baberton Beauty	
		Snapshot	Guide	
			Ayrshire Beauty	

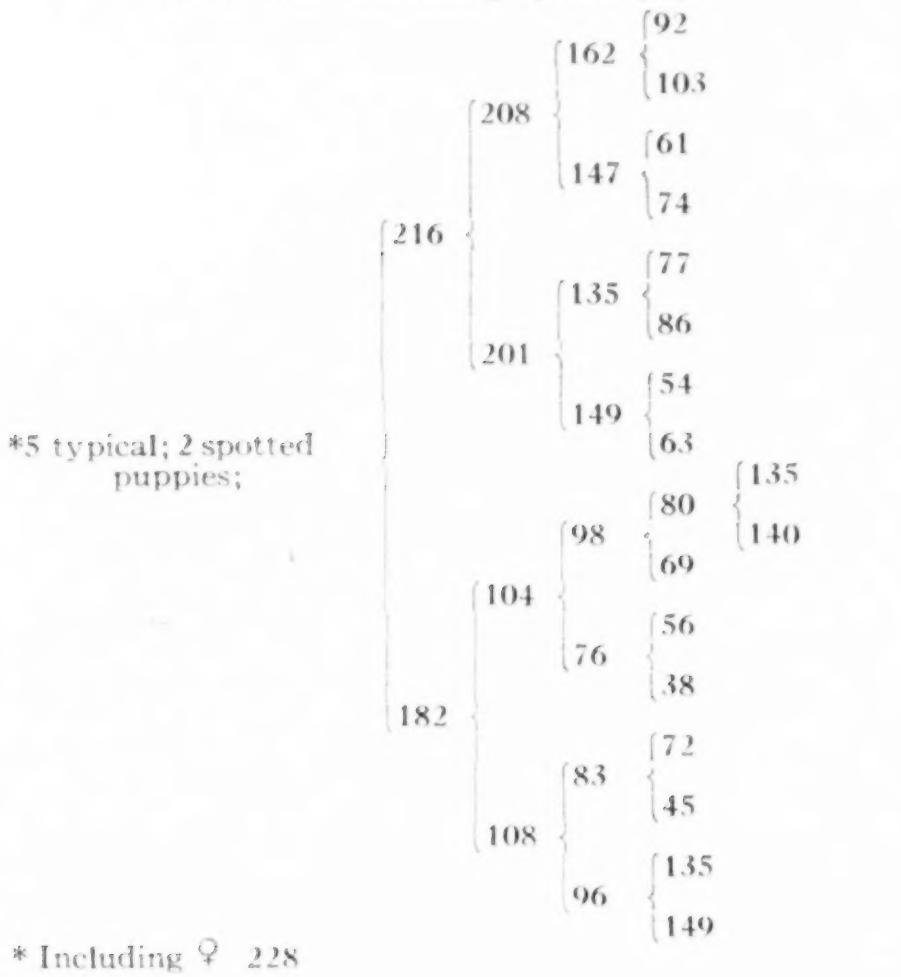
case was reported to me by Mr. Frederic Hood of Watertown, Mass., owner of the Boxwood Kennels. Mr. Hood has been most kind in placing the particulars of the case, as well as two of the puppies themselves, at my disposal. The interest which he has shown might well be taken as a model by all breeders and fanciers, who by adopting a similar attitude might do much to increase opportunities for cooperation with scientific institutions.

The history of this case is briefly as follows: A pedigreed and registered bitch (No. 182), an excellent specimen of the breed, was bred to a typical dog (No. 216), pedigreed, registered, and a bench show-winner. In due time a litter of seven pups, one male and six females, was obtained. Of these two, the male and one female, were heavily spotted with white. They were, according to Mr. Hood's manager, very similar to, though of course not identical with, the two spotted pups figured in Fig. 3, Nos. 1 and 2. The five remaining pups were all normal, and included among their number one which has developed into one of the best American bred Airedale bitches now being shown. This bitch (No. 228) was bred to a different dog (No. 294) and produced a litter of six puppies, three males and three females, all dead. Two of them, both males, were kindly sent to me in preservative by Mr. Hood and are figured in Fig. 3, Nos. 1 and 2. In conformation and ground color they are typical Airedales, but in size No. 1 is larger and No. 2 a bit smaller than is the average Airedale pup at birth. The other four pups in the litter were entirely typical in color and conformation and were born before the spotted pups which were the last two in the litter. One of the typical pups had, however, a cowl of his own skin which stretched bag-like over his shoulders and head. The head and neck were far from being properly developed. This puppy I did not see, but the description is taken from the personal observation of Mr. E. Warburton, the manager of the Boxwood Kennels, whose accuracy of description need not be doubted.

The pedigrees of the two litters containing spotted pups are given herewith. It will be noticed that ♂ No. 135 occurs in both pedigrees and on both sides of each pedigre. ♀No. 140 also occurs on both sides of the second pedigree and

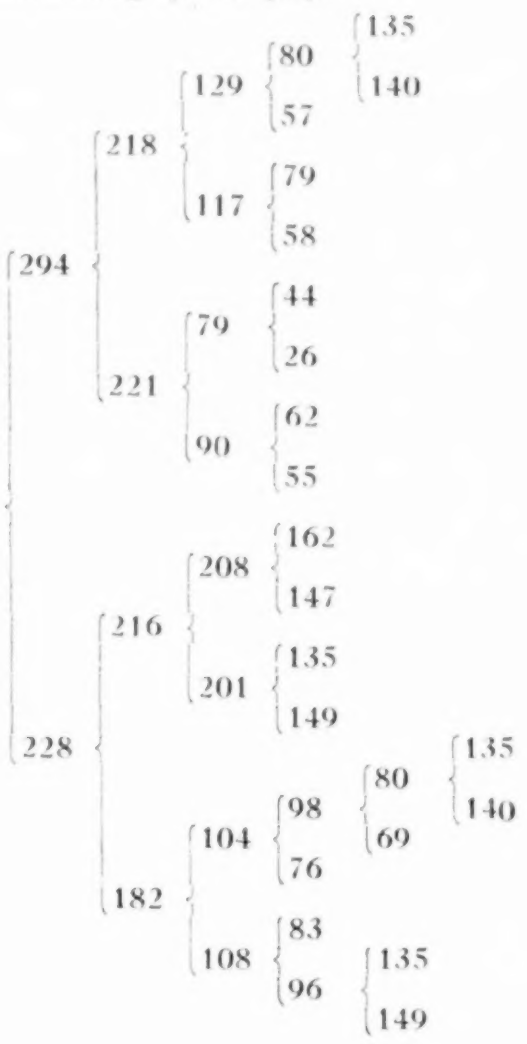
Table II.—*Pedigree of Spotted Airedale Terriers.*

First litter containing spotted pups



* Including ♀ 228

Second litter containing spotted pups



on one side of the first. It seems very likely that if a mutation producing spotted coat color took place in the gametes of any one individual, that ♂ No. 135 or one of its ancestors, was the animal in question.

Examination of Fig. 3, Nos. 1 and 2, shows that the amount of white on the coat of these puppies is considerable and that, like the Scottish terrier puppy already described, there is no possibility of its having been developed by selection from minute beginnings.

It is hoped that it will be possible to obtain certain of the animals from the spotted Airedale stock for breeding purposes and thus to ascertain more definitely the genetic nature of the variation.

University Wants Photographs of Twin Calves

The Department of Genetics at the University of Wisconsin is making a study of twins, particularly in cattle, and desires to secure photographs of twin calves. Those of spotted breeds are especially wanted. In this connection, particular interest attaches to the degree of similarity of markings on the duplicated parts of double monsters, such as those with two heads and a single body, or two bodies and a single head. These freaks are often "stuffed" or otherwise preserved, and the college will appreciate receiving any information relating to the existence of such specimens in museums or elsewhere, and how photographs or accurate sketches might be obtained. It is believed that a more accurate knowledge of the conditions in such cases will help toward an understanding of the larger problems of inheritance in cattle and other animals. Those who have any information that will assist in the above studies should write to the Department of Genetics, University of Wisconsin, Madison.

TEAS' HYBRID CATALPA

An Illustration of the Greater Vigor of Hybrids; Increased Growth and Hardiness as a Result of Crossing; Illustrating Definite Principles of Heredity

D. F. JONES AND W. O. FILLEY
Connecticut Agricultural Experiment Station, New Haven.

ALTHOUGH the number of artificially produced hybrid trees is small, compared to the number of crosses among other species, several noteworthy trees have been described from time to time which do not conform to any known kinds, and they have been attributed to an assumed hybrid ancestry. A good example is found in the James River walnut,[1] considered to be the result of a natural cross-fertilization of *Juglans regia* by J. *cinerea*. A similar tree has been described by Sargent [2]. Likewise the Lucombe oak,[3] the Carolina poplar,[3] the London plane [3] and the fir trees which originated at Bulgnéville, France,[4] have been regarded, upon reasonably good evidence, as natural hybrids. Lastly, Teas' hybrid catalpa so plainly exhibited characters of both *Catalpa Kaempferi* and *C. bignonioides* that Sargent [5] was convinced of its double lineage.

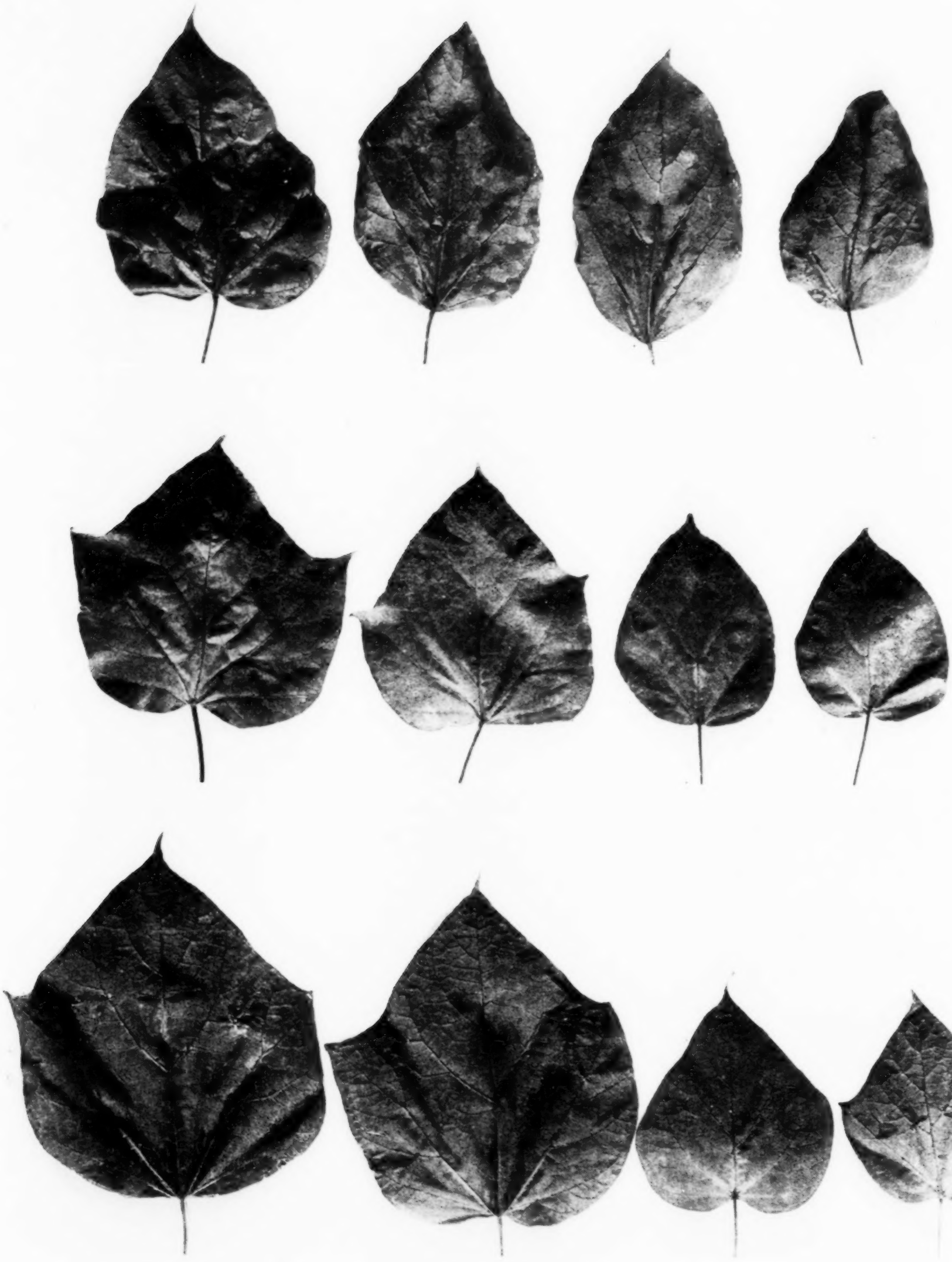
This latter cross has since been made from known trees of the two suspected parents. It is of more interest than as a mere illustration of a hybrid tree, to note that this plant agrees in every particular with the tree which was attributed to the parentage deduced from the characters it possessed together with the circumstances attending its origin.

ORIGIN OF THE HYBRID CATALPA

The history of the original hybrid is as follows, quoting from Sargent: "J. C. Teas of Carthage, Mo., while living in Indiana in 1864, purchased a seedling catalpa from Mahlon Moon of Morrisville, Pa., who raised it from seed procured from Japan by Hovey & Co., the Boston seedsmen. According to the statement of Mr. Teas, to whom I am indebted for the facts in the case, this tree, which proved to be *C. Kaempferi*, was planted in his nursery among or near plants of *C. bignonioides* and *C. speciosa*, the two North American species; and it produced in due time one pod of seeds which were quite unlike those of any catalpa with which Mr. Teas was acquainted. The seeds were planted and gave rise to a tree almost intermediate in character between *C. Kaempferi* and one of the American species. The appearance of this seedling tree and its progeny suggests that the pollen from a flower of one of the American catalpas had fertilized a flower of the Japanese tree. The American parent was probably *C. bignonioides*, although Mr. Teas is inclined to believe that it was *C. speciosa*. The latter flowers two or three weeks earlier than the Japanese species, whereas the former flowers contemporaneously with that species during the first week of July.

"Whatever may have been its origin, the hybrid . . . is an erect, vigorous, and rapid-growing tree, with the thin, scaly bark of the American species. The leaves are sharply three-lobed, or rarely entire, and more or less cordate at the base; they are slightly pubescent on the lower surface, and the mid-rib and primary veins are covered with scattered hairs; they are 12 to 15 inches

[1] Peter Bisset, "The James River Walnut." JOURNAL OF HEREDITY, 1914, 5:98–101.
[2] C. S. Sargent, "A Hybrid Walnut Tree." *Garden and Forest*, 1894, 7:434–436.
[3] W. H. Lamb, "Hybrid Trees." JOURNAL OF HEREDITY, 1916, 7:311–319.
[4] *Garden and Forest*, 1890, 3:308.
[5] C. S. Sargent, "A Hybrid Catalpa." *Garden and Forest*, 1889, 2:303–305.



COMPARING THE LEAVES OF DIFFERENT SPECIES OF CATALPA

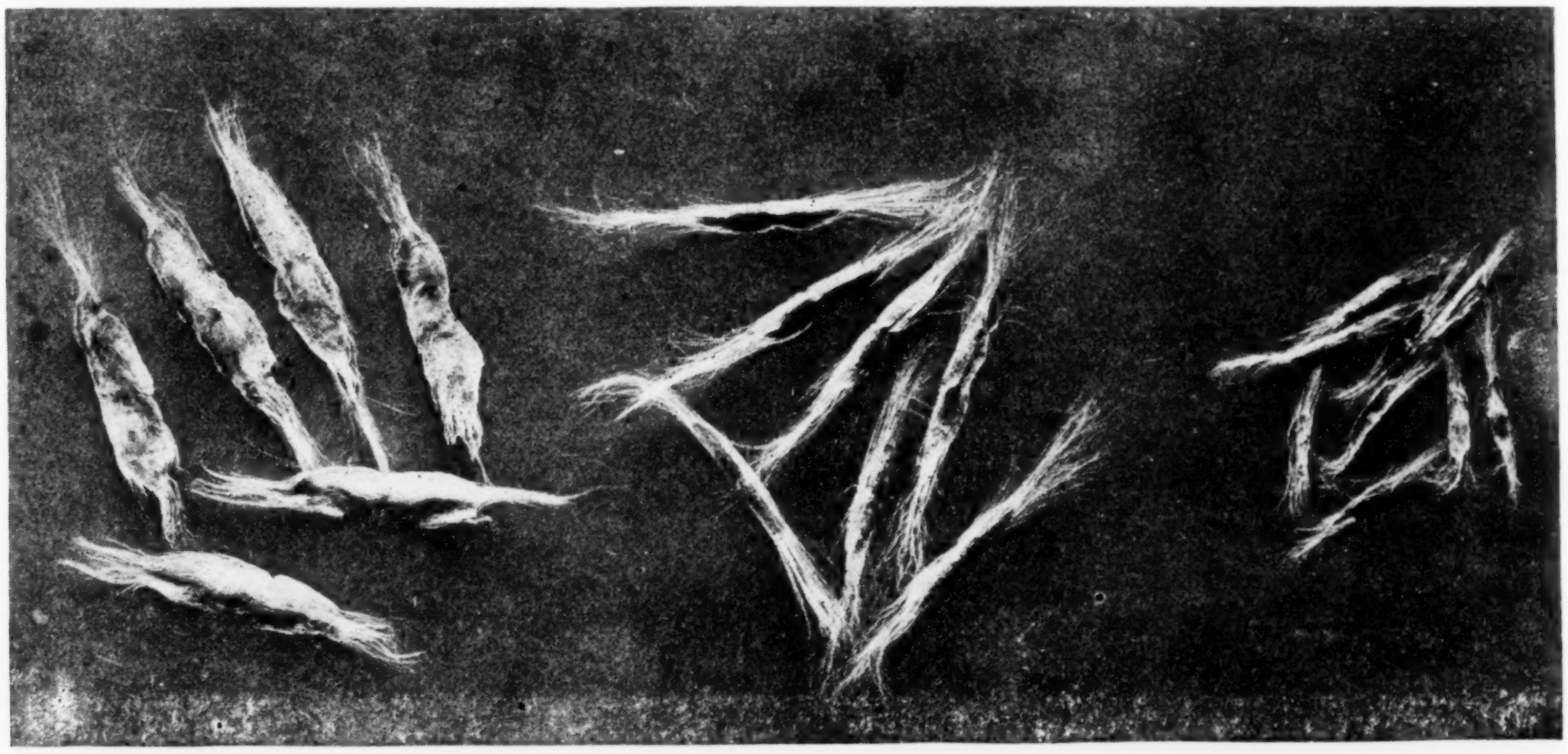
The leaves at the top are those of *C. bignonioides*, characterized by their ovate shape, with entire margin and pubescence only on the lower surfaces. Those in the center row are of *C. Kaempferi* which are generally three-lobed with velvety pubescence only on their upper surfaces. The leaves of the hybrid are shown at the bottom. Characters of both parents are expressed in these leaves which are generally three-lobed and pubescent on both surfaces. In color markings they more nearly represent the Japanese species. (Fig. 4.)

long and 10 to 12 inches broad. The inflorescence, which is 18 to 20 inches long by 10 inches wide, is composed of two or three hundred fragrant flowers about an inch long, the corolla slightly tinged with yellow in the throat, and handsomely marked with broad purple stripes. The fruit is from 12 to 15 inches in length and not more than a quarter of an inch thick in the middle. The wings of the seed are half an inch in length and one-eighth of an inch in width, and, like the others of the genus, are tufted with long, white hairs.

"The leaves of this tree are much larger than those of either of its parents, having, when they first appear, the velvety character and purple color peculiar to those of the Japanese plant, and the reddish spot at the insertion of the petiole with the leaf-blade which characterizes that species. They more generally resemble those of the Japanese species in shape, color and texture, while the pubescence which covers the lower surface is almost intermediate in character between those of the American and of the Japanese species. The inflorescence is much larger than that of the American or of the Japanese plants, being fully twice as large as that of *C. bignonioides* and more than three times the size of *C. Kaempferi*. The flowers are intermediate in size; in color and markings they most resemble those of the American species, although a tinge of yellow in the throat of the corolla points to their Japanese descent. The fruit of the hybrid is almost intermediate in size between those of the two parents, as are the seeds, which are perfectly fertile and often reproduce the original form in every particular. When, however, seedlings show a tendency to vary from the original form the variation is generally in the direction of the Japanese rather than of the American parent.

EXCELS JAPANESE SPECIES AS ORNAMENTAL TREE

"The hybrid is a more vigorous tree than either of the American or the Japanese species, and it grows rather more rapidly. It is too soon to speak of its value as a timber-tree, as the largest specimens in the western states where this tree has been much more generally planted than at the east, according to Mr. Teas, only 40 to 50 feet high, with trunks which do not exceed yet a diameter of 18 inches. Of its value as an ornamental tree there can be no doubt. Its larger size and more rapid growth, its better habit and more showy inflorescence make it a far more valuable ornamental tree than the



CATALPA SEEDS

The seeds of the hybrid are intermediate in size between those of the parents but are much greater in number, and the wings, "like the others of the genus are tufted with long, white hairs." (Fig. 5.)

PODS OF THE HYBRID CATALPA AND PARENT SPECIES

"The fruit is from 12 to 15 inches in length and not more than a quarter of an inch thick in the middle," and thus intermediate in size, but the pods are numerous and contain many seeds. The number of flower clusters and total amount of seed produced per tree is much greater on the hybrid than on either of the parent species. (Fig. 6.)

Japanese species; it is more hardy than either of the North American species, and, although the flowers are smaller, the panicles and the number of individual flowers are much larger."

In 1911 Dr. E. M. East, at the Connecticut Experiment Station, crossed *Catalpa bignonioides* by *C. Kaempferi*, this being the reciprocal combination of Teas' undoubted hybrid. The actual pollination was made by Prof. H. K. Hayes. The trees were grown and measured by him for the first years of the experiment and later came into the hands of the writers. The cross was made by emasculating the flowers of the *bignonioides* parent, enclosing them in bags and later applying pollen by hand. Seed was collected from the same trees as used in making the cross which were well isolated from each other. The three lots of seed were sown in the spring of 1912. Later they were transplanted to their permanent position, ten trees of each being set at the station farm at Mt. Carmel, near New Haven, and 75 of each on the upland near Portland in the central part of the same state. With these, in each location, were set a like number of trees of *C. speciosa* which were started one year later. It is unfortunate that these were not started at the same time, but they afford some comparison.

VIGOROUS GROWTH OF THE HYBRID

As can be seen in Table I, the plants grew vigorously. During the summer of 1915, the plants at Mt. Carmel were severely damaged by wind, the branches being badly broken, particularly those of the cross, as it was growing the most rapidly. Consequently, in order to have them start even again, it was

TABLE I.—*Height of Catalpa Bignonioides, of C. Kaempferi, of Their Hybrid, and of C. speciosa (average, in feet, of ten trees grown, at Mt. Carmel).*

Year	Age	*C. bignonioides*	*C. bignonioides* C. kaempferi*	*C. kaempferi*	*C. speciosa*	
1912	1	0.2	0.4	0.2	1913	0.8
1913	2	1.5	2.3	0.8	1914	2.2
1914	3	3.7	4.9	2.6	1915	6.9
1915*	4	9.9	8.7	5.7	1916	9.2
1916	5	7.4	9.3	5.8	1917	10.5
1917	6	10.3	11.3	8.2	1918	11.2
1918	7	11.4	13.1	9.1		

* Trees severely damaged by wind breakage so that all plants were cut to the ground and only one sprout allowed to grow the following year.

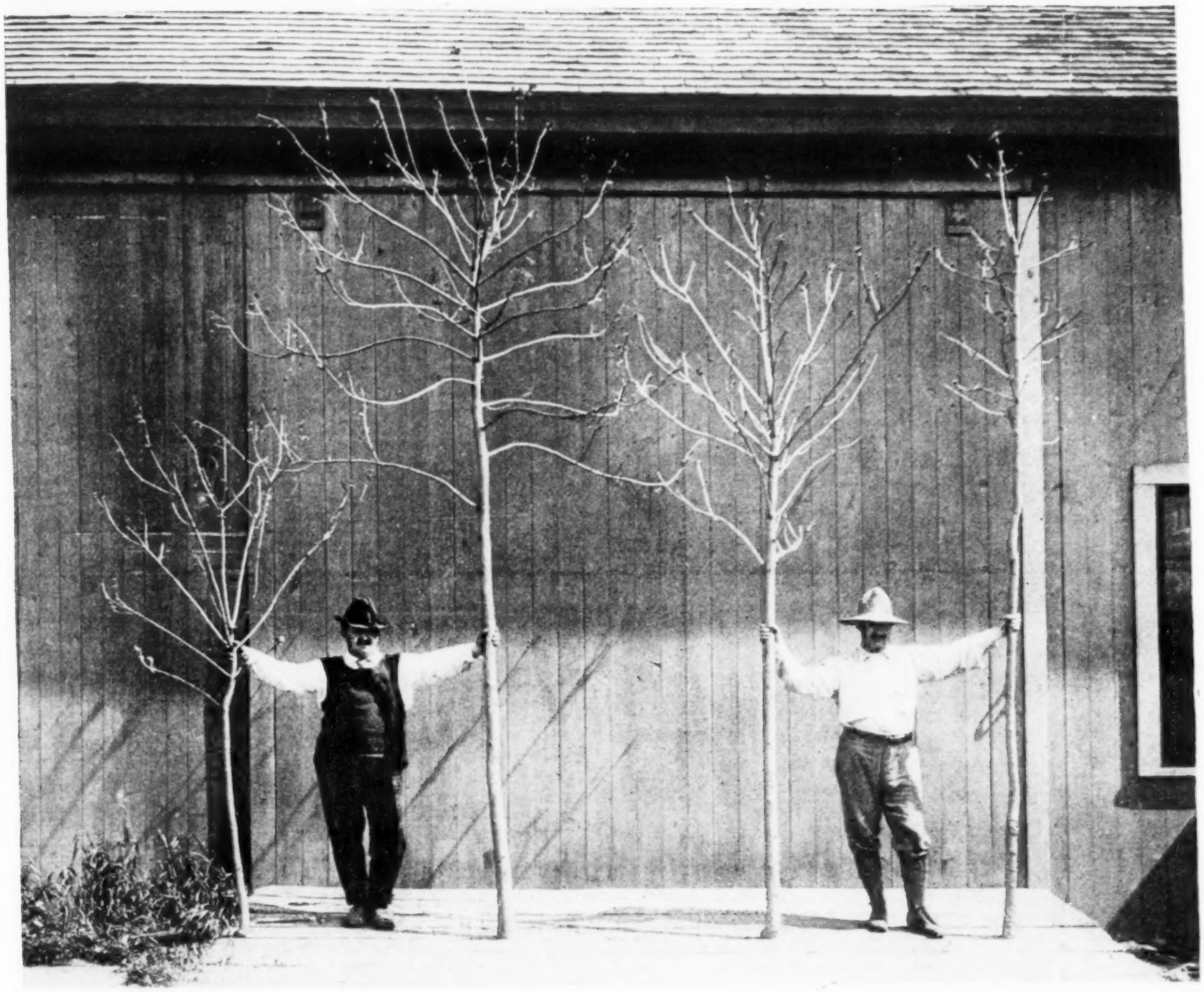
decided to cut the trees to the ground before the following growing season. It is the usual practice with catalpas, when they are grown for timber,to cut them back after one or two years as the trunks are then straighter and the trees make fully as much growth in the end as when they are not cut back. Afterwards the trees were limited to one sprout.

The greater growth of the hybrid was easily apparent after the trees were well started, as shown by the figures in the table and the trees shown in Fig. 7. The increased vigor of the hybrid is even more than that indicated by the figures. The larger parent at Mt. Carmel, *C. bignonioides*, did not flower until 1918, and then produced only a few pods on one or two trees. The Japanese species flowered in 1915 and every following year. The cross likewise flowered with it. In addition, therefore, to making a larger vegetative growth, the cross has expended energy each year upon seed formation, which the larger parent has not done to any appreciable extent. In the profusion of its bloom and the abundance of seed this cross is a remarkably fine illustration of the vigor frequently derived from species hybrids. In amount of seed produced, it is from five to ten times more productive than either parent, a notable instance of the temporary advantage given to some crosses in natural competition.

As grown at Mt. Carmel, in the southern part of the state, both parents and their offspring have proven to be perfectly winter-hardy. At Portland, about 30 miles north, the *bignonioides* parent has suffered severely. During the latter years it has been killed to the ground every winter, growing from the base each spring in a mass of sprouts. The Japanese parent and the cross have so far been unharmed. Although the distance is small between these two localities, it should be remembered that one passes from one biological zone to another (Upper Austral to Transitional) in going from Mt. Carmel to Portland, Conn. The advantage which the hybrid has over both parents is consequently much accentuated as *C. Kaempferi* is naturally a small grower. The combination of the two species, possessing the larger growth of one parent together with the greater viability of the other, far surpassed either parent in this location.

INHERITANCE OF PARENTAL CHARACTERISTICS

The detailed characteristics of each parent, and the way they are expressed in the hybrid, are arranged in Table II. There is an intimate mingling of the features of both parents, so that this plant affords a good example of a species cross of the type studied with so much interest by the early hybridists such as Kölreuter, Gärtner, Focke and others. It is not strange that investigators, working with such material as this, did not make much progress in arriving at any definite principles of heredity While some characters in this illustra-

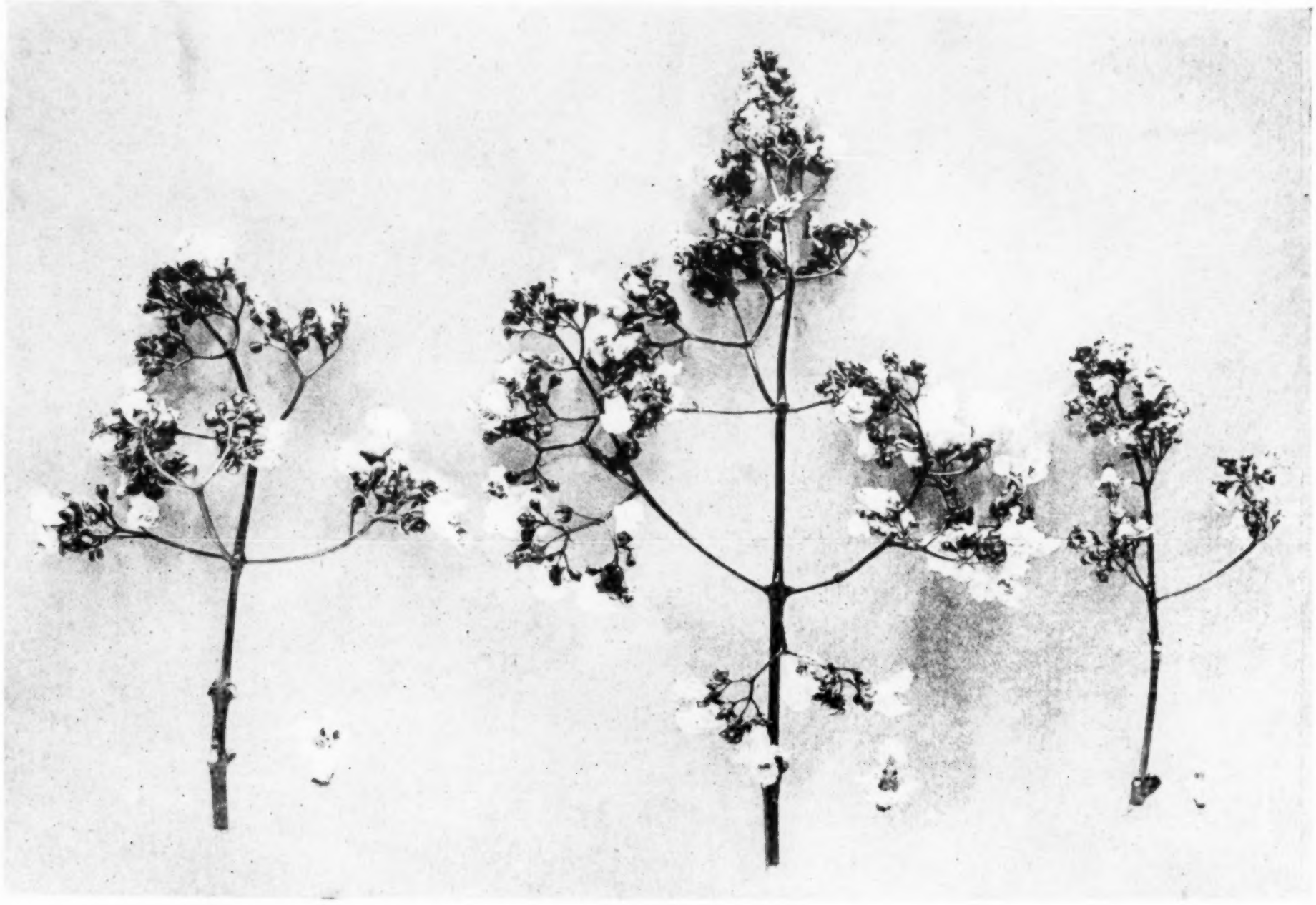


REPRESENTATIVE TREES AFTER SIX YEARS OF GROWTH

A good illustration of vigor in a tree hybrid (second from left) combining features of both its parents—the small Japanese catalpa *C. Kaempferi* and the native *C. bignonioides* on either side. C. speciosa is shown at the extreme right for comparison. (Fig. 7.)

tion are expressed in an alternative fashion, the hybrid is intermediate for the most part. In every part of the tree contributions from both parents can be made out. This is shown very clearly in the leaves. The oriental catalpa is finely pubescent on the upper surface, the leaves having a velvety feeling, but are entirely smooth on the lower surfaces. The native tree is the reverse of this, being glabrous on the upper surface and hairy on the lower side of the leaves, with rather coarse filiments, especially on the veins. The hybrid, however, resembles both parents in these respects, the leaves being velvety on the upper surface and hairy on the under sides, the latter, sparingly however, and only on the young leaves.

In the same way, one can trace the other characters and find some influence of both parents on the hybrid in nearly every part of the tree. On the other hand, in the nature of the bark, the margin of the leaves, the coloring in certain parts of the leaves and flowers, the inheritance is definitely alternate, the features of one parent in some parts, and of the other parent in other parts, being predominant upon the product of their union. In dimensional characters the hybrid is intermediate except in those parts which are affected by vigorous development such as height of plant, diameter of trunk, size of leaves and inflorescences. In these the hybrid clearly excels its parents. It is interesting to note that the size of cells, as shown by tracheid length, at least, is the same in both parents and the cross

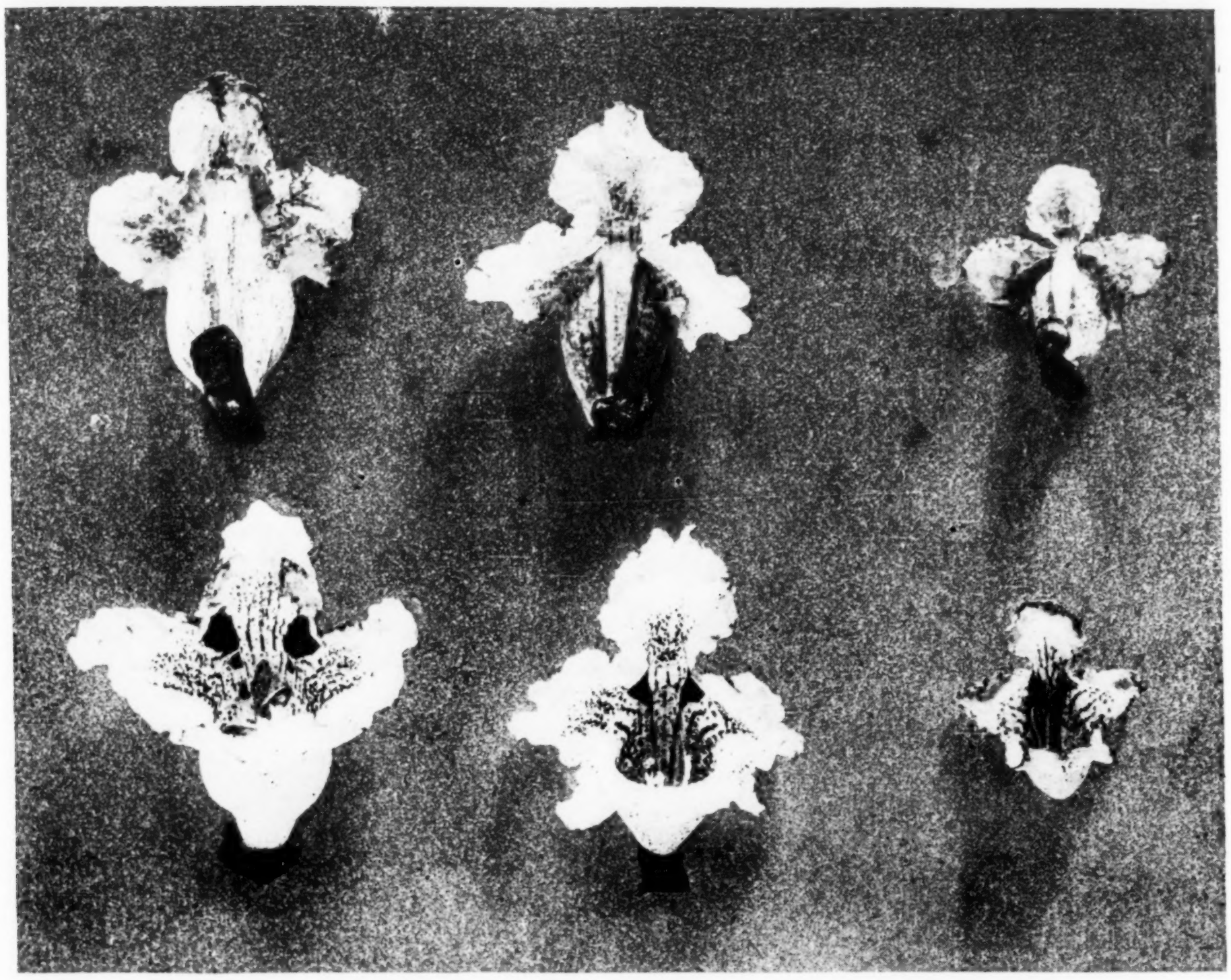


INFLORESCENCE OF DIFFERENT SPECIES COMPARED

The inflorescence of the hybrid, shown in the center, is larger than that of either parent, *C. bignonioides* at the left and *C. Kaempferi* at the right. (Fig. 8.)

TABLE II.—*Comparison of the First Generation Hybrid of Catalpa Bignonioides by C. Kaempferi with Its Two Parent Species.*

	C. bignonioides	*C. bignonioides C. kaempferi*	*C. kaempferi*
Bark	Rough	Smooth	Smooth
Leaf, upper surface	Glabrous	Pubescent	Pubescent
lower surface	Hirsute	Sparingly hirsute on young leaves.	Glabrous
shape	Generally ovate	Generally cordate	Generally cordate
margin	Entire	Three-lobed, rarely entire.	Three-lobed, rarely entire.
Petiole	Slightly colored only on young leaves.	Colored	Deeply colored
Insertion of petiole	Uncolored	Colored on young	Colored on all leaves.
Notches in veins	Uncolored	Uncolored [leaves]	Colored.
Flower, color	White with brownish-purplish spots and orange stripes.	White with brownish-purplish spots and orange stripes.	Pale yellow with brownish-purplish spots and dark yellow stripes.
length	3 to 3.5 cm.	3–3.5 cm.	2 cm.
breadth	3 to 3.5 cm.	2.5–3 cm.	2 cm.
Pods, length	30 to 35 cm.	20 to 40 cm.	20 to 30 cm.
breadth	1 to 1.5 cm.	.5 to 1 cm.	.3 to .5 cm.
Seeds, length	2 to 2.5 cm.	2 cm.	1 cm.
width	.7 to .8 cm.	.3 to .4 cm.	.2 to .3 cm.
hair length	2 cm.	1.5 to 2 cm.	.7 to .8 cm.



INDIVIDUAL FLOWERS OF THE CATALPA SPECIES

The flowers of the hybrid are somewhat narrower than those of the larger flowered parent but are similarly white in the ground color, while the other parent is yellow. Likewise in the orange color of the large stripes the hybrid resembles *C. bignonioides*, as the small flowered parent has dark yellow stripes. (Fig. 9.)

In addition to being resistant to low temperatures the combined plant is less affected by the leaf spot, *Macrosporium catalpae*, E. & M., which attacks all catalpas, but, as observed, the spotting of the leaves has been much more severe on C. *bignonioides* than on the other parent and the cross. Perhaps there is some relation here to the pubescence of the leaves.

PRACTICAL USES OF THIS TREE

The value of the hybrid, in its more rapid growth, greater hardiness and profuse blooming, recommends itself to the landscape gardener. The flowers are not difficult to manipulate and each pod contains a large number of seeds, so that it is quite feasible to produce the first generation crossed trees for use as ornamental plantings. As a timber tree, it is rather doubtful whether the hybrid has a sufficiently greater growth than *C. speciosa*, the tree usually grown, to warrant its production for that purpose. However, a catalpa grove is a fairly permanent investment, the trees growing up from the stumps after each cutting, thereby extending the usefulness of one planting over a long period of time, so that considerable expense in obtaining the seed might well be justified. Therefore, it would be well worth while to try this hybrid in those localities where catalpas are more extensively grown for posts and ties.

The seeds produced by the hybrid trees are well developed and are fertile. A sample tested in the incubator gave 51 % viability. None of the second generation plants have been grown from this

cross. Sargent speaks of their reverting to Kaempfer's species in flower color. It is of course to be expected that they will show segregation. It is quite possible that something in the way of a new catalpa of value can be fixed from this cross. It would be a matter of growing a large number of seedlings and selecting for several generations. The trees flower young, so that this would not be as hopelessly slow a proposition as with most trees. Since the history of many valuable plants points clearly to their hybrid beginnings, it seems well worth continuing this hybrid into later generations. The likelihood of obtaining anything of value would depend largely upon the number of trees grown. For this reason the Connecticut Station would be glad to furnish almost any quantities of seed from the first crossed plants, which would give the segregating generation, to anyone who would be interested in growing them. The trees require little attention after they are once started, and in many places catalpa growing has proven to be a profitable commercial venture. The segregating generation would not give as uniform a tree as the pure species and probably would not be so profitable to grow, but might ultimately produce a new tree of real merit. In view of the results secured from this cross, other crosses of these two species with *C. speciosa* would be worth trying.

Since the hybrid artificially produced from *C. bignonioides* and *C. Kaempferi* coincides with the natural hybrid described under the name of "Teas' hybrid catalpa," and therefore confirms its assumed parentage, this fact lends considerable probability to other cases of hybrid trees whose ancestry can be no more than guessed at by a comparison of the characters of the new form with its possible parent species.

As an illustration of hybrid vigor, it is one more to be added to the long list of augmentations of growth immediately resulting from crossing. In this case it is particularly easy to see how many superficial features have been contributed by both parents, and this may be taken as one indication that the greater size and hardiness possessed by the hybrid is similarly due to the combined action of favorable growth factors contributed by compatible but diverse parents.

LECTURES ON HEREDITY AND SEX (delivered in Glasgow, 1917-18), by F. O. Bower, J. Graham Kerr, and W. E. Agar. Pp. 119, with 46 illustrations. London: Macmillan & Co., Ltd., 1919.

The authors announce that they have tried "to convey in as simple terms as possible the leading facts relating to Sex in Animals and Plants, together with suggestions bearing on the use and effect of sexual propagation." The evolution of sex is taken up at some length. Heredity is disposed of in a conventional manner with a brief account of Mendelism and a more extended discussion of correlations between parent and offspring. The book contains many sound suggestions, but is probably too detailed and technical for the ordinary reader, while for the serious student the absence of references will be a drawback.—P. P.

SEX CONTROL, by John William Conway. Pp. 118. Kansas: The Norton Champion, 1919.

Mr. Conway, who is apparently not familiar with the large amount of careful work that has been done during recent years on the problem of sex control, has brought together a confused mass of information, which he first published in his local weekly newspaper. The two tangible theories which he espouses are the time-honored ones that (1) the offspring is of the sex of the weaker or less passionate parent, and (2) that the offspring is of the sex of that parent which is best nourished. Mr. Conway makes no attempt to reconcile the contradictions of these two theories, and he also drags in prepotency, atavism, and various other more or less mystical ideas, to complicate the situation still further. No new evidence of value is included in support of his thesis.—P. P.

SOME PROMISING NEW PEAR STOCKS

BEVERLY T. GALLOWAY

Office of Foreign Seed and Plant Introduction, Washington, D. C.

PRACTICALLY all of our important cultivated fruit crops, the apple, pear, plum, cherry, peach, prune, apricot, and nectarine, are in a sense parasites, for they must get their life and sustenance from special roots selected and provided by man. These roots are known as stocks, and millions of them are imported every year and used by nurserymen in the conduct of the largest business of its kind anywhere in the world. There are between five and six million acres of bearing apple, pear, and cherry trees in this country, and all but an insignificant portion are being fed and supported by roots having their origin in far-away France or Italy.

We are interested at this time in pear stocks, stocks coming from free-seeding, stabilized species; stocks that will grow vigorously throughout our principal pear-growing sections; that may be economically and easily produced by nurserymen; that will not leaf-blight; that are highly resistant to fire-blight; that will produce a large percentage of No. 1 trees in the nursery; that may be budded any time from June to September, and that will give a long-lived tree.

WHY NEW TYPES ARE NEEDED

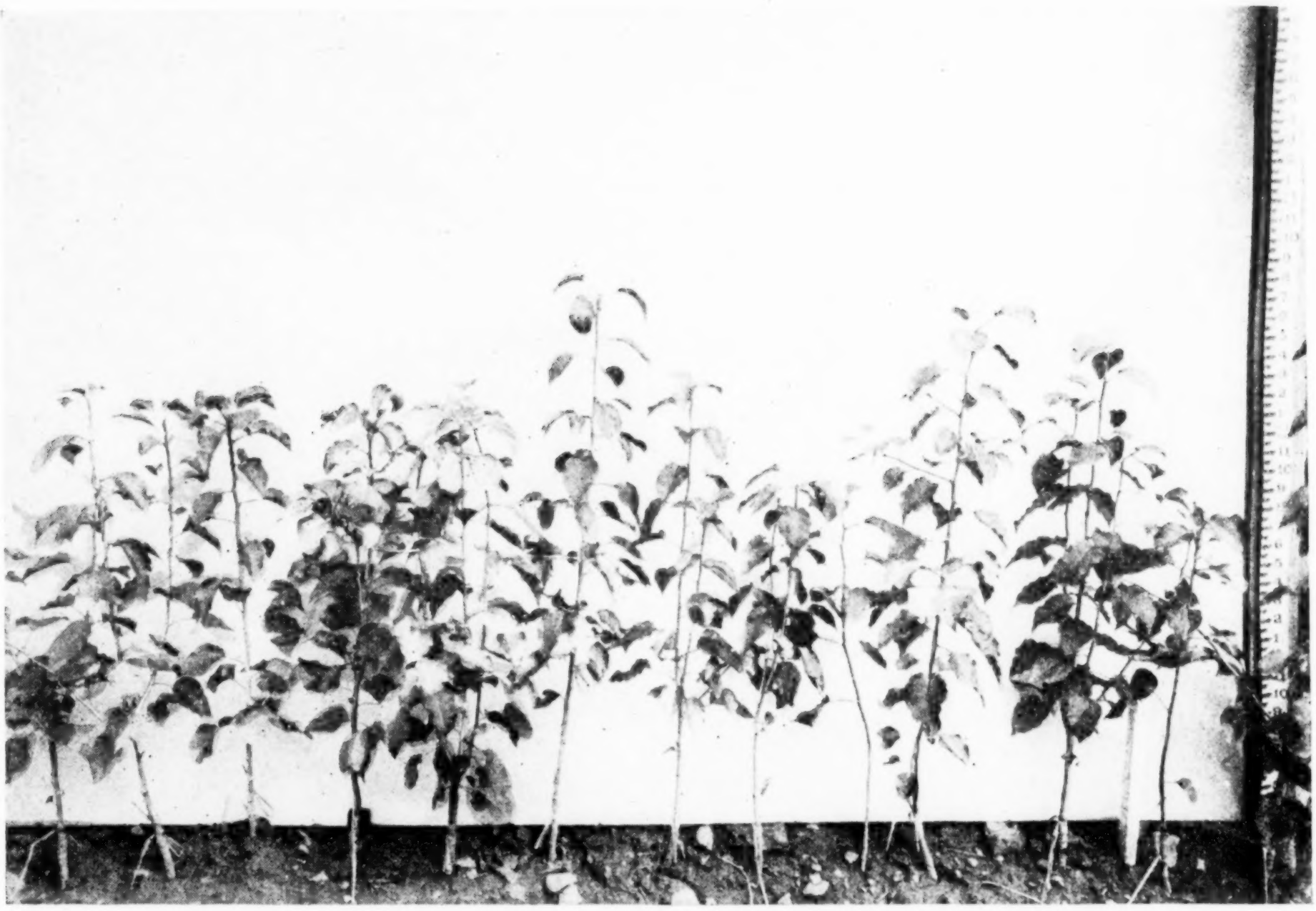
During the past fifteen years the Office of Foreign Seed and Plant Introduction, in the United States Department of Agriculture, has introduced a good many pears—somewhat over 350, in fact. During the past two years special attention has been given to a restudy of these introductions with a view to ascertaining their value: (1) for stocks; (2) for breeding purposes, that is, their use as a means of securing, through breeding, new types of pears; and (3) their use and value as new or fruiting types just as they were introduced.

The number of pear trees of all ages in this country is probably not far from twenty-five million. The total acreage and production of pears has remained more or less constant for the past eight or ten years. While the acreage and production have remained constant, this is only made possible by extensive new plantings each year. Fire-blight is the great bane of the pear in this country. From four to five million young trees must be raised each year to meet the losses caused by fire-blight and the normal increases of orchard extension. Fully 90% of all our pear trees are grown on French seedlings. The production of these seedlings from the common wild pear, *Pyrus communis*, has long been an important horticultural industry in France.

No systematic attempt has been made, so far as we are aware, in this or any other country to secure new types of pear stocks suitable for special needs and particular places. Nor has any serious attempt been made to study the larger question of *congeniality*. We know that the same variety of pear behaves differently on different types of stocks. These differences are more marked in the case of different species, but they are also noticeable where seedlings of the same species are used. Much work, therefore, remains to be done to find the best stocks for particular varieties of our cultivated pears and stocks best suited to particular regions, soils and climates.

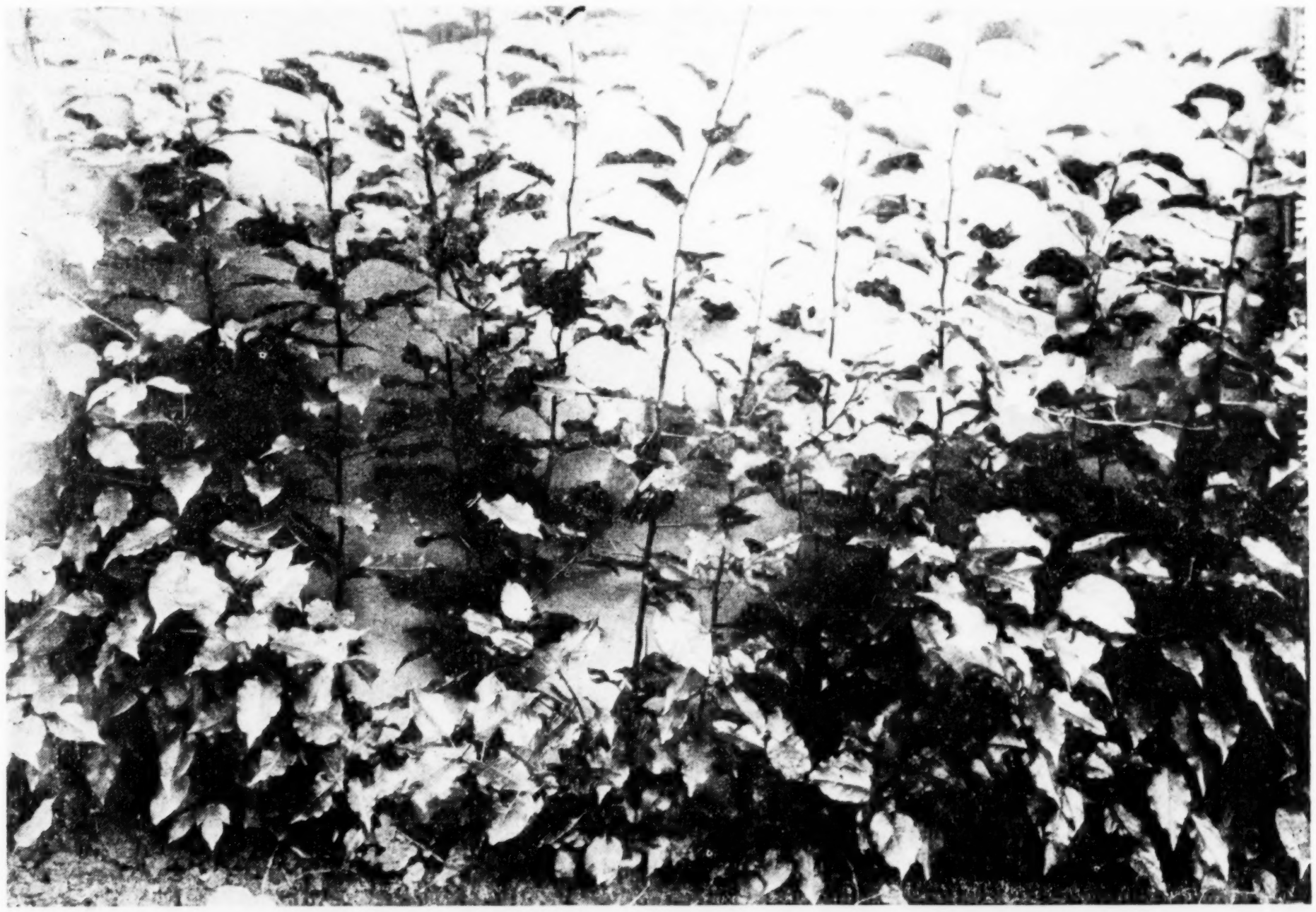
CHINA'S ABUNDANT STOCK MATERIAL

The Orient, and particularly China, seems to offer the most fruitful field for new pear stocks. China is pecu-



THE USURI WILD PEAR, PYRUS USURIENSIS, FROM CHINA

This wild pear grows abundantly in China, Korea, Manchuria and Siberia. In the United States it has proved to be a very slow grower, and of doubtful value as a stock. Budded August 1; photograph August 14, 1919. (Neg. 25436.) (Fig. 10.)



THE KUAN LI, OR CHINESE WATER PEAR

This is a cultivated form of the Usuri pear, and is a very promising stock. Compare the growth with that shown in Fig. 10 above. Within a year or two, it is expected that seed of this valuable type of pear can be furnished from the government plant station at Chico, Cal.; budwood can be secured at an early date. The above photograph made Aug. 14, 1919. (Neg. 25425.) (Fig. 11.)

THE CHINESE SAW-LEAVED PEAR, PYRUS SERRULATA

A very promising stock. It is a strong grower and has good foliage, comparing favorably with the Kuan li. This photograph (Aug. 14, 1919) was made of some discarded spec mens, all the good plants having been cut off to save the buds. (Neg. 25441.) (Fig. 12.)

THE BIRCH-LEAVED PEAR, PYRUS BETULAEFOLIA

This is a vigorous grower and free from leaf blight. Compare these with Fig. 14 on page 30, which shows some Japanese seedlings almost completely defoliated by leaf blight. Photograph Sept. 11, 1919. (Neg. 25482.) (Fig. 13.)

liarly rich in distinct species of pears, and we should look to these wild species, rather than cultivated varieties, for our best stock material. The most extensive work on pears with particular reference to the securing of stocks, resistant or immune to fire-blight, has been done by Mr. F. C. Reimer, of the Oregon Experiment Station. Mr. Reimer began his work five or six years ago and has assembled probably one of the largest collections of pears in the world. The special pear station located at Talent, Ore., where Mr. Reimer is conducting his investigations, is one of the great pear-growing sections of the United States. This is in the Rogue River Valley. Fire-blight is very destructive in this valley and at other places on or near the Pacific coast. The blight frequently attacks the bodies or trunks of the trees, and it was largely to meet that situation that Mr. Reimer inaugurated a line of work, having for its primary object the discovery of types that would give a blight-resistant root and body upon which the susceptible tops could be worked. It is believed by Mr. Reimer that if blight-resistant or blight-immune trunks could be secured, the disease might be held in check among the branches by rigid attention to surgical and antiseptic methods. Mr. Reimer's valuable work is still in progress, and he is now on a second trip to the Orient for the purpose of securing new facts and new pear material.

THE WORK OF FOREIGN EXPLORERS

We are indebted to two agricultural explorers for the larger number of pear species and varieties now at our disposal for study, testing and trial. The late Frank N. Meyer, of the Office of Foreign Seed and Plant Introduction, and Mr. E. H. Wilson, of the Arnold Arboretum, have rendered horticulture incalculable service in supplying material that has already proved very promising. Mr. Meyer's collections are quite extensive and have been widely disseminated. Beginning in 1905 and continuing until his death in 1918, Mr. Meyer collected and sent in more than 125 separate and distinct lots of pears. This represents probably fifteen or twenty species and twenty-five to thirty varieties. A good many of Meyer's pears are assembled at the Chico, Calif., Field Station of the Office of Foreign Seed and Plant Introduction. Quite a large collection of Meyer's and other pear introductions have been brought together and are now being grown at the Yarrow Field Station near Washington, D. C.

Mr. Wilson began his work on pears more than a dozen years ago and, under the direction of Dr. C. S. Sargent, of the Arnold Arboretum, has assembled a fine collection of oriental and other species at the Arboretum near Boston, Mass. The following notes are based chiefly on field studies and tests at our field stations and work in cooperation with nurserymen and others:

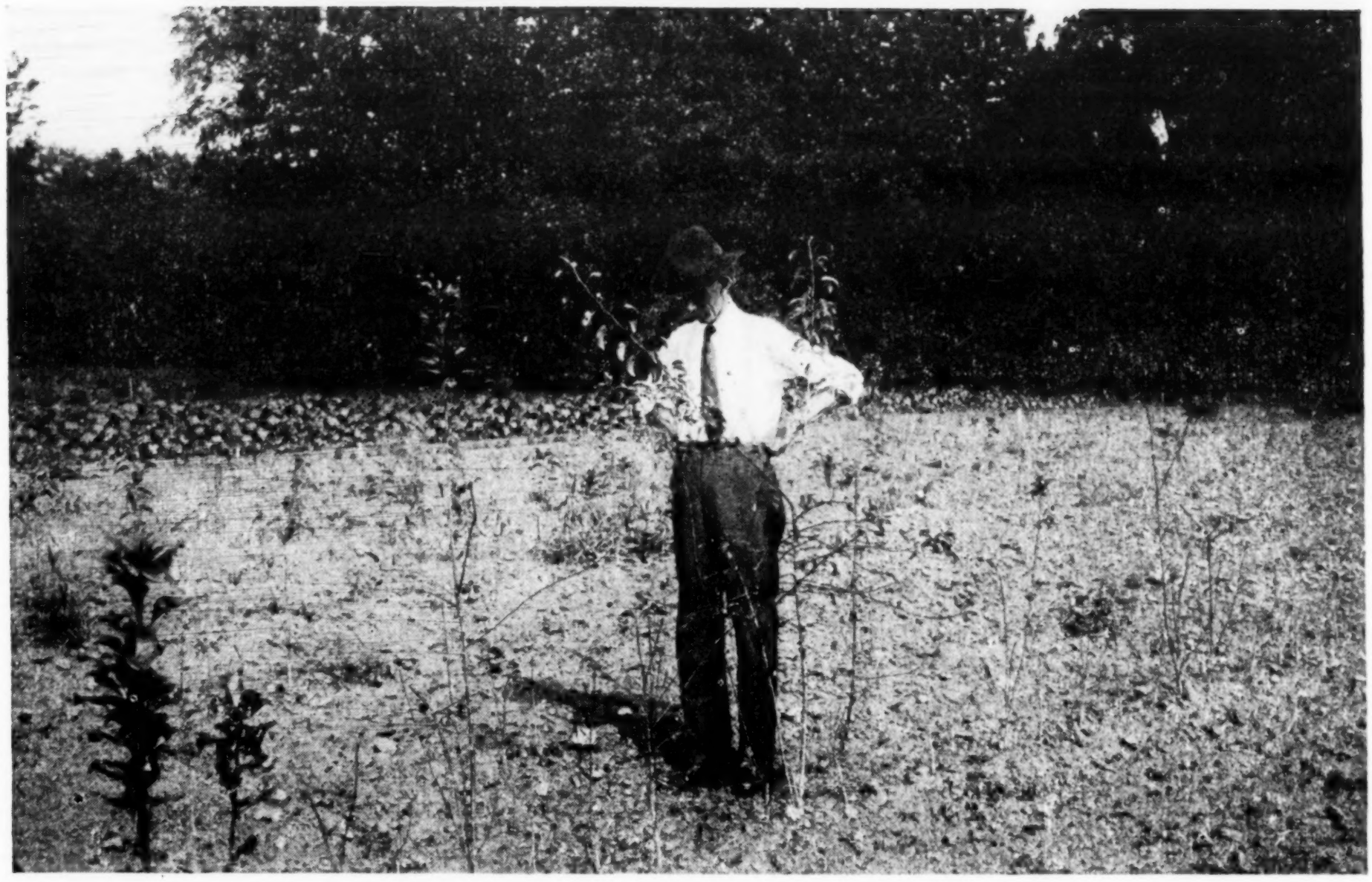
The Usuri Wild Pear, Pyrus usuriensis, S. P. I. No. 44237 (see Fig. 10).—This wild pear, first found along the Usuri River, north of Korea, has been known to botanists for more than fifty years. It has a wide range, having been found in numerous places in Korea, China, Manchuria and Siberia. Meyer reported it in great abundance from Chihli Province, north of Pekin, in 1907. In 1916 he revisited the region and found many of the trees of this wild pear had been cut down and Indian corn or maize was being grown in their place. Wilson found the pear growing abundantly in northern Korea. The experiments made by Reimer with seedlings of this pear gave much encouragement at first, for they proved to be very resistant to fire-blight. With us it has proved a very slow grower, rather subject to leaf-blight, and therefore unable to hold its leaves during the budding and propagating season. We can hardly class this pear as a promising new stock. Our object in introducing it here is a precautionary one. The pear has been considerably exploited as a stock. Seed is being offered, and aside from the question of the authenticity of the seed, there is the broader problem of the actual value of the seedlings for

stock purposes. Fig. 10 shows the habit of the seedlings in the nursery row. We have budded eight or ten of our principal varieties of pears on this stock. Not more than 30% of the buds took. The bark is tough and frequently refuses to "slip" easily. In striking contrast there is shown in Fig. 11 a cultivated form of the Usuri pear found by Meyer in 1917, in the Chihli Province, China.

Kuan li or *Chinese Water Pear*, S. P. I. No. 44235 (see Fig. 11).—This pear unquestionably belongs to the Usiuriensis group. Meyer reported it as having small fruits flattened somewhat like an apple and of a rusty, greenish color. He sent in but one lot of seed of 17 ounces. From these seeds several thousand seedlings have been grown and tested as stocks at several places. Our first tests were with grafted stocks. All the pears worked on this stock, including Bartlett, Clapp's Favorite, Anjou, Dutchess, Lawrence, Seckel, Sheldon, Howell, Clarigeau, and others, are doing very well in the nursery row. Unfortunately, the source of further seed supply from China is doubtful. In the maze of Chinese pears it is questionable if anyone except an expert could relocate the type from which Meyer obtained his original supply of seed. In order to preserve this valuable type of pear we have had top-worked, at the Chico, Cal., Station, a part of an old pear orchard to the Kuan li, and within a year or two we should be getting seed from this source. We shall also be prepared at an early date to furnish budwood of this pear to those who may desire to propagate it for seed production. We place the Kuan li as one of our most promising pear stocks.

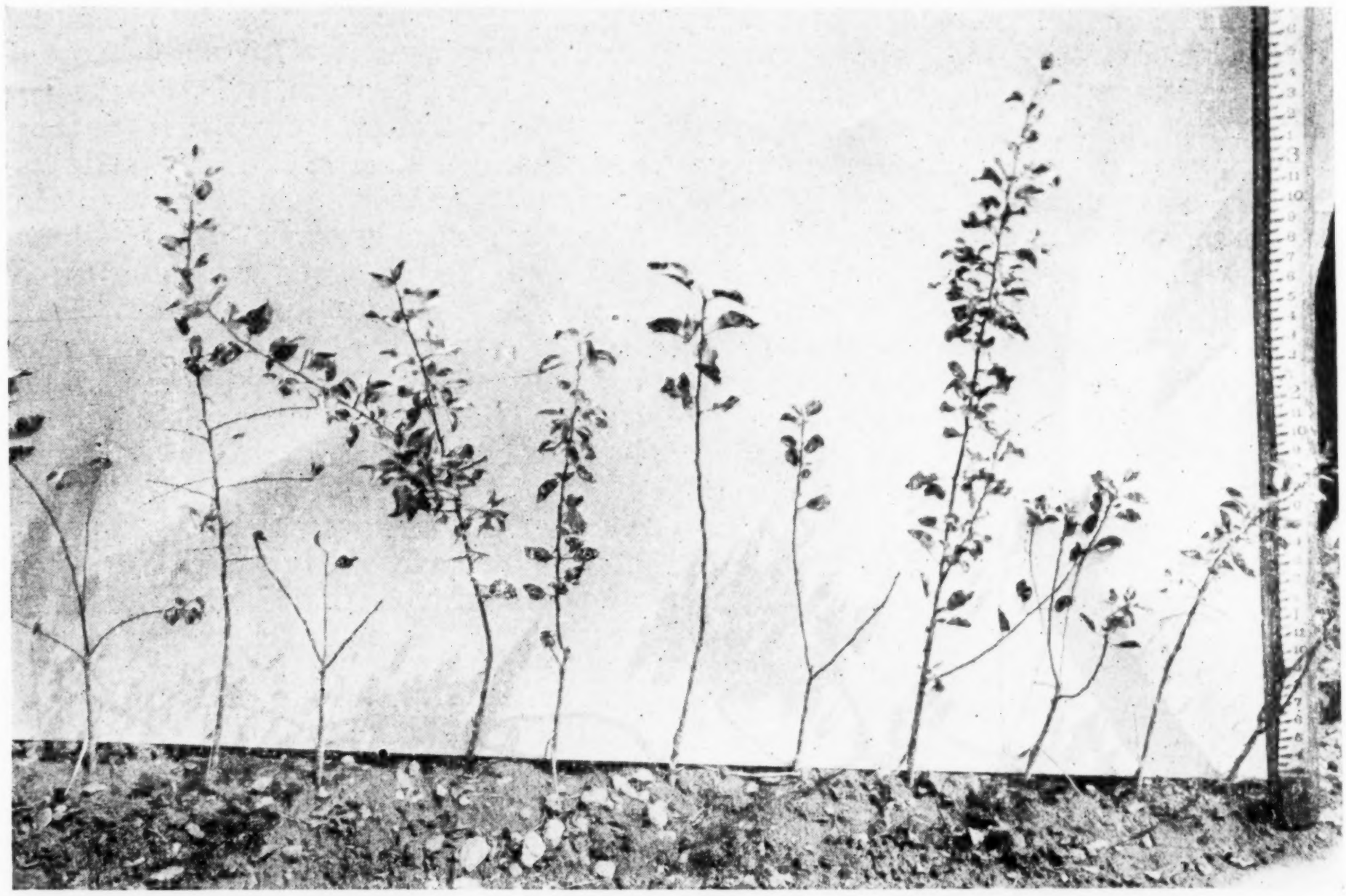
The Chinese Saw-leafed Pear, Pyrus serrulata, S. P. I. Nos. 34567 and 45832 (see Fig. 12).—This pear, first collected by Wilson in 1907 in the Hupeh Province, 800 or 900 miles west and south of Shanghai, was again found by Reimer near Ichang, China, in 1917. Ichang is in Hupeh Province. Reimer found the pear about 15 miles northwest of Ichang at elevations from 3,000 to 3,700 feet. Its growth in the nursery compares favorably with the Kuan li. It is affected but slightly with leaf-blight, holds its foliage well in our hot summers, and has a long budding season. Our plants are from seeds sent by Mr. Reimer. The species does not appear to be common, and for this reason, if it should prove on further trial to be a useful stock, sources of supply should be established here. Authentic seed may be obtained from the Arnold Arboretum, but the supply there is naturally limited. We shall be in position to supply budwood in limited quantities from our collection. Buds from our principal varieties of pears worked upon this stock took well. It is too early to determine the value of the stock in producing an ideal nursery tree.

The Birch Leaf Chinese Pear, Pyrus betulaefolia, S. P. I. No. 21982 and other S. P. I. Nos. (see Fig. 13).—This pear has come to the Office of Foreign Seed and Plant Introduction from a number of places and has been listed under several S. P. I. numbers. Meyer collected it several times and Reimer sent in seeds of it. According to the late Jackson Dawson, it came to the Arnold Arboretum from the mountains near Pekin, China, in 1882. Fine specimens are now growing in the Arboretum. The tree occurs in many parts of China, and supplies of seeds for commerical purposes would not be difficult to get. Reimer reports it as being more or less susceptible to fire-blight. In the east we have never seen it blighted. No attacks of blight, so far as we are aware, have appeared on the trees at the Arnold Arboretum, and these are now more than thirty years old. The tree has proved practically free from leaf blight. It is a vigorous grower and is capable of being budded any time from July to the middle of September in the region around Washington. According to Reimer it is extensively used in China as a stock, where it is readily grafted, making a good union and producing vigorous trees. The pear can be readily grown from cuttings. Fig. 13 shows the re-



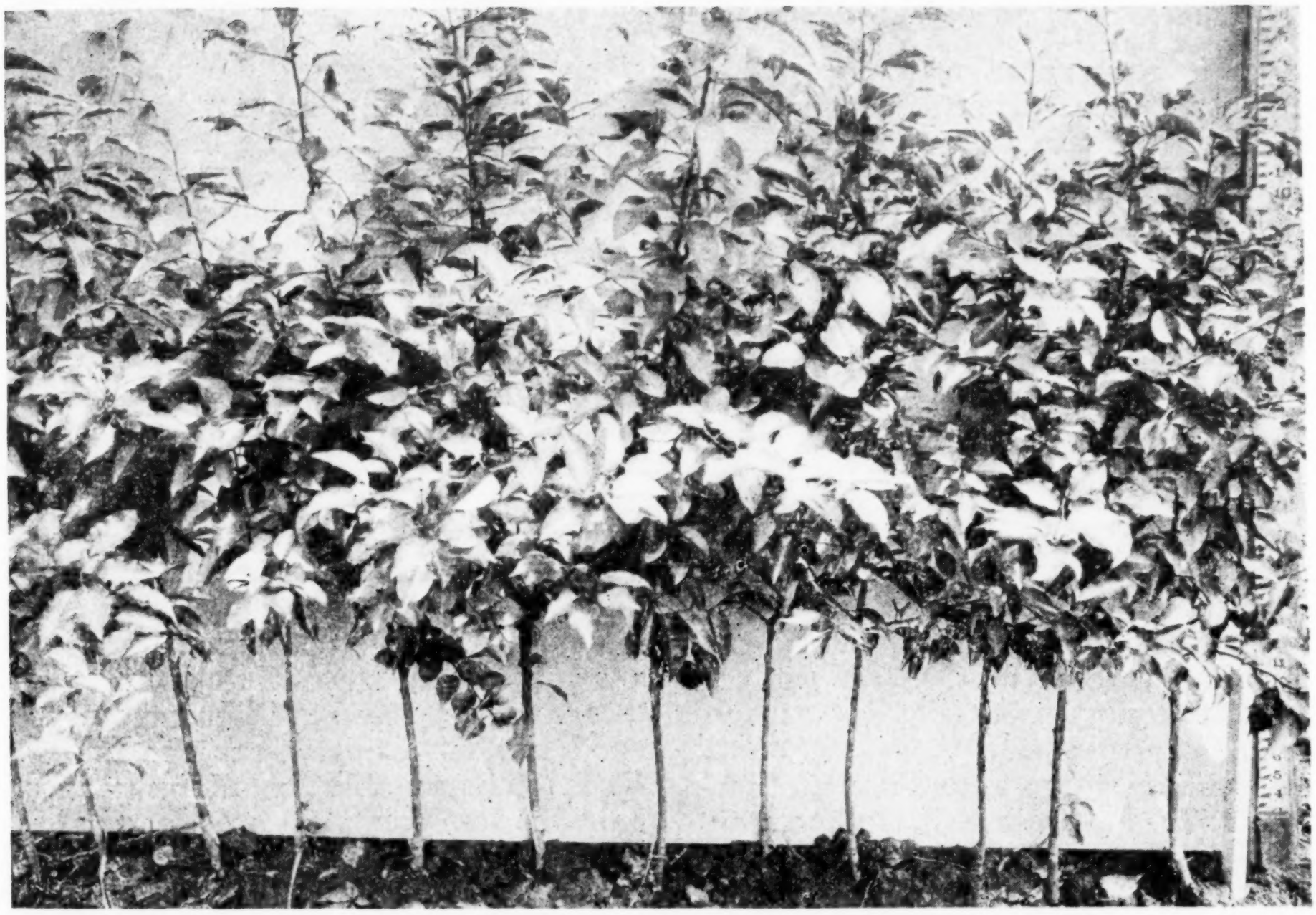
ORDINARY JAPANESE PEAR SEEDLINGS

Pear seedlings such as are commonly used by nurserymen. These are badly leaf blighted and incapable of being budded. Photograph made Sept. 11, 1919. (Neg. 25484.) Compare this with Figs. 15 and 16. (Fig. 14.)



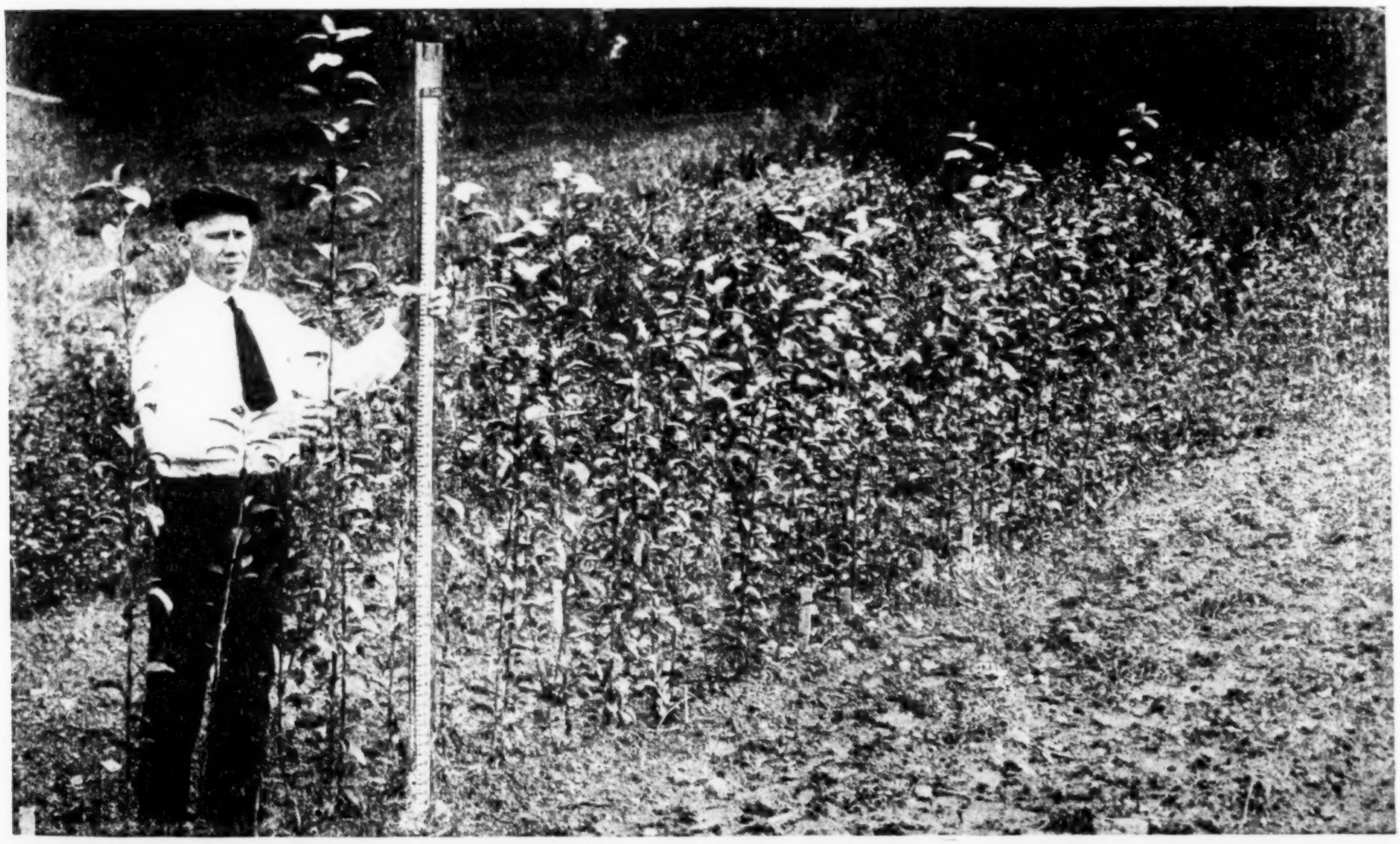
ORDINARY FRENCH PEAR SEEDLINGS

Millions of these are used for stocks in this country. They are weak growers and very subject to leaf blight. Photograph Aug. 14, 1919. (Neg. 25443). Compare this type with that in Fig. 16, a photograph made on the same day and at the same distance from the trees. (Fig. 15.)



THE CHINESE CALLERYANA PEAR

This is the most promising of all the Oriental species. It is a fine grower and can be budded from July to September. Compare it with the French stocks (Fig. 15). Cooperative planting of trees for seed purposes is now under way to assure a home-grown supply of this remarkable species. Photograph Aug. 14, 1919. (Neg. 25437.) (Fig. 16.)



USE OF THE CALLERYANA PEAR AS A STOCK

Roots of this stock were grafted with a cultivated pear in the spring of 1919, and the above photograph was taken August 14, 1919. In three and a half months the growth was nearly six feet. The variety is a new pear supposed to be a cross between Keiffer and La Conte. (Neg. 25426.) (Fig. 17.)

markable manner in which this pear holds its foliage. The photograph was taken on September 11, 1919. At this time the leaves on the Japanese seedlings (see Fig. 14) and the French seedlings (see Fig. 15) were practically all off, largely as a result of the attacks of the leaf blight fungus, *Entosporium maculatum*.

The Chinese Calleryana Pear, Pyrus calleryana, S. P. I. No. 44044 and other S. P. I. Nos. (see Fig. 16).—Of all the pears tested and studied this remarkable Chinese species holds out the greatest promise as a stock. The tree has a very wide range in China, and several distinct types have already appeared. It has stood some very severe winters during the past twelve years at the Arnold Arboretum. It grows and thrives luxuriantly at our Field Station, Brooksville, Fla., where it is almost an evergreen. One of the last important pieces of work of the late Frank Meyer was the collection of more than 100 pounds of the seed of this pear in the mountains in and around Ichang, China. After many trials and heart-breaking delays, Meyer got the seed to us, but before it could be put in the ground his body was floating in the great Yangtze River, that giant of waters which for centuries has taken its human toll. Alone for months, with many dangers around him, he wrote:

"I am sitting now in a Chinese house, for the inn I lived in at first was too noisy and dark, and there was no room to dry seeds or specimens. Some mice are running about, mosquitos buzz, a cricket sings in an old wall, and the policeman who is stationed to spy upon me snores on the bench, for it is well into the night. Tomorrow we may go to see a lot of pear trees 15 miles from here."

All who have tested the Calleryana pear as a stock, report favorably upon it. It is a vigorous grower under nearly all conditions. It holds its leaves well, and it can be budded any time from July 1 to September 1. All of our best kinds of pears so far tried take well upon it. The seedlings are easily grown and, when from pure types, run remarkably uniform. Commercial supplies of the seed are not yet available, but it is believed that considerable quantities can be obtained through one or two reliable sources in China. Meanwhile it is important to assure ourselves of a home-grown supply of this most promising species. To this end coöperative planting of trees for seed purposes, and coöperative efforts in top-working other trees with the Calleryana species are under way. Wood is now available for the latter object. The remarkable uniformity and vigor of the seedlings are shown in Fig. 16. This picture was taken August 14, at which time most of the French seedlings (Fig. 15) were entirely defoliated. Fig. 17 shows the growth of spring-made grafts on this stock. The variety is a new pear supposed to be a cross between Kieffer and La Conte. The grafts were put out May 1 and the photographs taken August 14, three and a half months later. By October 1 these grafts averaged 7 feet in height.

Summarizing, it may be said that the prospect of finding new and valuable pear stocks among the oriental wild species seems very good. What the ultimate life of our principal varieties of cultivated species on these stocks may be remains to be determined. This is a long-time problem. Already there is sufficient encouragement to go forward with the work in the hope that we shall eventually not only be able to produce all of our own stocks but produce them, having all the desirable characteristics set forth at the beginning of this paper.

THE DECLINE OF AUTOCRACY AND ITS RELATION TO WARFARE

A Look into the History of the Last Five Centuries—Autocracy Associated with Wars—Tendencies toward Democracy in Development of Modern Civilization

FREDERICK ADAMS WOODS

Lecturer on Biology, Massachusetts Institute of Technology

CAN war be abolished? Will autocrats disappear? Are democracies less prone to warfare than are other forms of government? To what extent have the great tyrants of the past been responsible for the warfare that has been waged? These are some questions to which we would like an answer.

Without supposing that history can positively answer these questions, it is justifiable, considering the importance of the subject, to seek what light we may; and so it is interesting to make an appeal to the extended records of the past and see if there is any evidence that autocrats have been long disappearing, or that they have been a predisposing cause of war. It will doubtless be of welcome interest to many persons to know that history's answer to both of these questions is in the affirmative. European autocrats have been decreasing numerically ever since the twelfth century—those of the more powerful sort since the sixteenth.

In regard to their relation to war, it is highly probable that states of warfare, whatever be their cause, are especially favorable to single-handed governance. Therefore we ought not to say that great autocrats are here shown to be a cause of war, though very likely to a considerable extent they may be; but at least we have evidence that the two are associated. This is proved by an analysis of the history of eleven European nations. The nations include Austria, Denmark, England, France, Holland (or the Netherlands), Poland, Prussia, Russia, Spain, Sweden, and Turkey. The period covered extends from the present day to as far into the past as records are available. For most of these countries, however, it is not practicable to carry such a study back of the sixteenth century. For England and France the records enable us to extend the research to the beginning of the twelfth century.

YEARS OF WAR

It would of course be of added interest if something more than the mere years of war and years of peace could be discussed, since it may be that great wars were more associated with autocrats than were small wars, but in the absence of sufficient data there can be no harm in first making the simple analysis and answering the question: Are autocracies especially associated with periods of war? Any book of dates concerning periods of war will conflict somewhat with any other book, since a certain amount of personal judgment necessarily enters into any compilation. Sometimes it is hard to tell a war from a riot. More often it is hard to tell just when a war begins and ends. Mr. Alexander Baltzly compiled under my direction, and in association with the Department of Government in Harvard University, a complete list of all European wars of modern times. This was published in 1915. It was put together just prior to the late war with the hope of throwing light on the question whether there was any evidence that wars were tending to disappear. This book, "Is War Diminishing?" is, as far as I know, the only source of appeal for a comprehensive study of European wars. Some special studies concerning the wars of single

nations have been published, but these are detailed and isolated—often mere propaganda. In Mr. Baltzly's lists we have an excellent basis for making a first approximation in the study of the causes of war, since the greatest effort was made to cover the ground completely, and, moreover, as the compilation was made without having the present research in mind, its errors should cause no bias.

A LIST OF AUTOCRATS

The next question is: Whom shall we include in a list of the great autocratic rulers of recent times? Here, again, it is necessary to be systematic and to overlook as few examples as possible. Some sort of a check-list is essential. Such a list is, as far as sovereign rules are concerned, already published, and is to be found in the appendix of my "Influence of Monarchs" (1913). It was formulated for another research, namely, to measure the magnitude of the personal influence of one recurring historical type, and the very fact that it was made for another purpose makes it all the better as a basis for the present discussion.

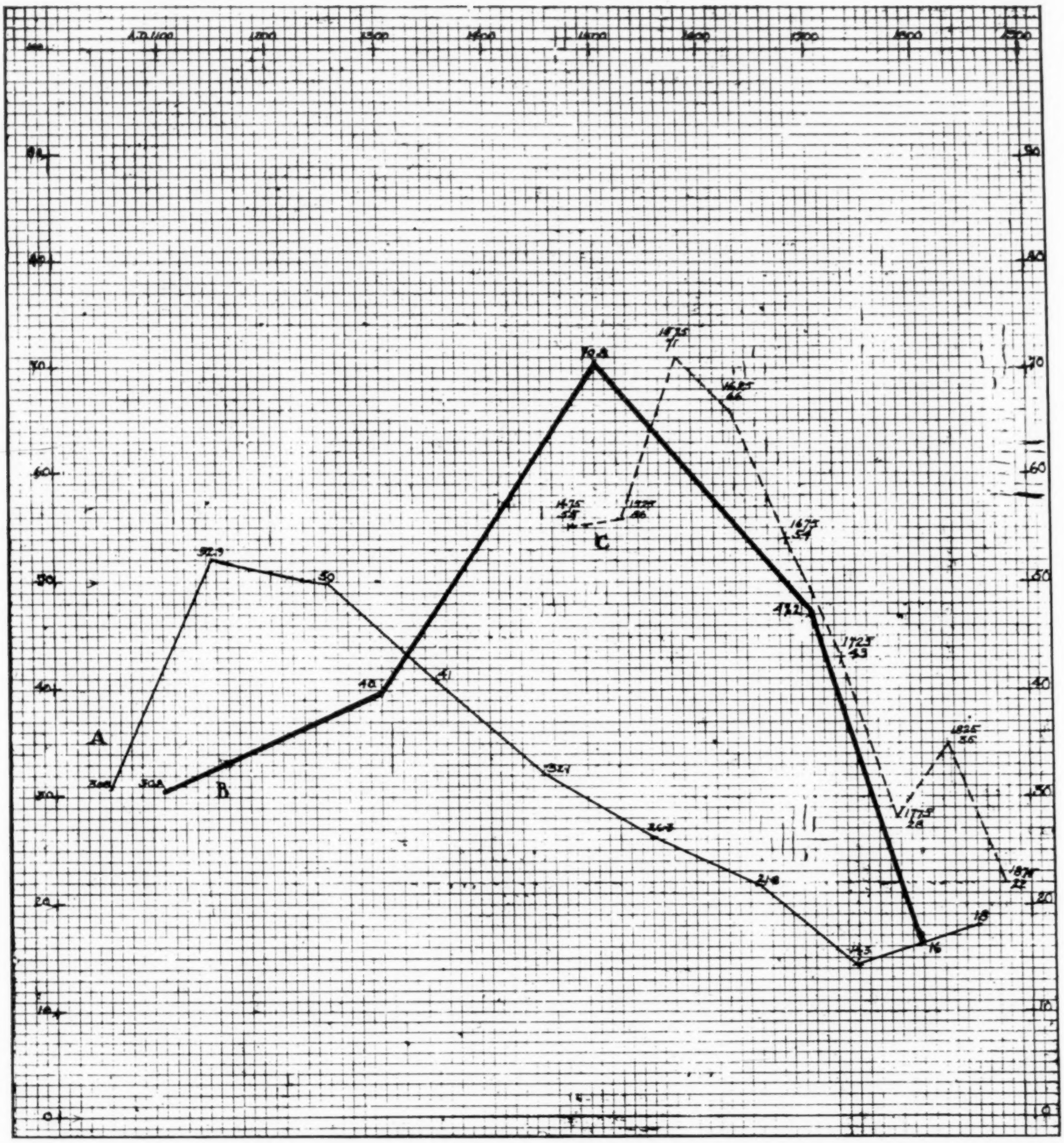
From this list of sovereigns I first picked out all those who undoubtedly should be rightly designated by the word *autocrat*: that is, those who were autocratic not only by nature, but also actually were able to act in an autocratic manner. To these I added a few doubtful names,—sovereigns who wished for personal control but who did not very well succeed in attaining their ends.

Names taken from the history of these same European countries from the French Revolution to the present day, and also from the history of the old kingdom of Poland, were added to the list in order that the periods covered in "Is War Diminishing?" should be completely included here. This produced a total of about 120. These were then roughly graded in an order of eminence and in the following manner: Mr. T. Lothrop Stoddard, Mr. Alleyne Ireland and myself each chose separately the names of: First, the ten seemingly greatest autocrats; second, the twenty greatest; and third, the sixty or leading half of the whole. I have now extended this to 100 names and arranged the first sixty in the order of their autocratic greatness on the combined basis of our separate ratings. In the lower portion of the list the order of position means but little, but in the upper part the differences are more clearly marked and are also more important in leading to significant conclusions. Probably the first ten or twenty names are not very different from those that would, perforce, be chosen by anyone conversant with European history if the test were to be, as it here is, the grading of autocrats according to the vastness of their whilom rule and the extent of their individual domination, not necessarily according to their intellectual gifts.

The following twenty monarchs are given in their order of eminence judged solely as great autocrats: Napoleon, Frederick the Great, Peter the Great, Selim I of Turkey, Suleiman the Magnificent, Ivan the Terrible, Louis XI of France, Philip II of Spain, Louis XIV of France, Catherine II of Russia, Charles XII of Sweden, Charles V (the Emperor); Gustavus Adolphus, Philip Augustus, Louis IX of France, Henry VIII of England, Ivan III of Russia, Henry IV of France, William II(the late Kaiser), the Great Elector of Brandenburg.

It must not be thought that the order within the group is important, or that there is any intention of conveying the idea that each one of these persons whose name appears ahead of some other person is known to be a greater autocrat. Every reader through personal preference would rearrange this list; but any rearrangement within the first ten, or within the second ten, would make no difference. If many were transferred from high to low positions, or if great changes of inclusion and exclusion were made, then important differences in the conclusions might result. It seems unlikely that such wholesale changes could be justified.

A list is here given of the 62 sovereign



HISTORY OF AUTOCRATS AND WARS AS TOLD BY A DIAGRAM

A. Showing the decline of all autocrats.
B. Showing the rise and decline of the twenty greatest autocrats.
C. The dotted line shows the decline in percentage of war-years per century. (Fig. 18.)

rulers who have been selected as especially representative of autocratic sway (see Table I). The first 30 are given ranking numbers, though, as before stated, this must be considered only as tentative and approximate. That this arrangement in a series has a value seems to be interestingly illustrated in this research, for, if the sovereigns had not been individually graded, the discovery would not have been made that European history furnishes actual evidence that great autocrats are especially associated with periods of warfare.

If we consider only the evidence drawn from the entire 62 autocrats, we find 914.5 years of war out of a total of 1,779 years of reign. This is 51.4% and is only slightly greater than the

TABLE I.—*Leading Royal Autocrats of Europe*

	War years	*Total*	*Years of reign*
Austria:			
26 Maximilian	17.0	26	1493–1519
12 Charles V	0.0	2	1519–1521
22 Maria Theresa	16.0	40	1740–1780
Francis Joseph	8.5	68	1848–1916
	41.5	136	
Denmark:			
Christian II	6.0	10	1513–1523
Christian IV	22.0	52	1596–1648
	28.0	62	
England:			
Henry I	25.0	35	1100–1135
Henry II	6.5	35	1154–1189
Richard I	7.0	10	1189–1199
25 Edward I	16.5	35	1272–1307
Edward III	33.0	47	1330–1377
Henry V	6.0	9	1413–1422
Henry VII	5.5	24	1485–1509
16 Henry VIII	12.0	38	1509–1547
23 Elizabeth	39.0	45	1558–1603
	150.5	278	
France:			
Louis VI	20.0	29	1108-1137
14 Philip Augustus	25.0	43	1180–1223
15 Louis IX	11.5	34	1236–1270
Charles V	12.0	16	1364-1380
7 Louis XI	6.0	22	1461–1483
Anne, Regent	1.0	8	1483–1491
Catherine de Medici	4.0	11	1560-1571
18 Henry IV	10.0	22	1588–1610
9 Louis XIV	34.0	54	1661–1715
1 Napoleon	10.0	10	1804–1814
Napoleon III	11.5	18	1852–1870
	145.0	267	
Holland:			
27 William the Silent	9.0	9	1575–1584
Maurice	25.0	41	1584–1625
Frederick Henry	22.0	22	1625–1647
William II	1.0	3	1647–1650
William III	17.5	30	1672–1702
	74.5	105	
Poland:[1]			
Casimir IV	23.5	45	1447–1492
Sigismund I	20.5	42	1506–1548
Stephen Bathory	3.5	11	1575–1586
John III	14.0	22	1674–1696
	61.5	120	
Prussia:			
20 The Great Elector	10.5	48	1640–1688
Frederick William I	5.0	27	1713–1740
2 Frederick the Great	11.0	46	1740–1786
19 William II	4.0	30	1888–1918
	30.5	151	

[1] Poland was not included in the Influence of Monarchs, nor was the history of any European country later than the Napoleonic period. Data from recent history have therefore been added.

Russia:			
17 Ivan the Great	24.0	43	1462-1505
6 Ivan the Terrible	32.5	37	1547–1584
3 Peter the Great	23.0	36	1689–1725
10 Catherine II	13.5	34	1762–1796
Alexander I	4.5	15	1810–1825
29 Nicholas I	29.5	30	1825–1855
Alexander III	0	13	1881–1894
	127.0	208	
Spain:			
21 Ferdinand and Isabella	17.5	25	1479–1504
Ferdinand	4.0	12	1504–1516
Charles V	25.0	39	1517–1556
8 Philip II	39.0	42	1556–1598
Charles III	2.5	29	1759–1788
	88.0	147	
Sweden:			
28 Gustavus Vasa	7.0	37	1523–1560
Charles, Regent	0.5	5	1595–1600
Charles IX	11.0	11	1600–1611
13 Gustavus Adolphus	13.0	21	1611–1632
Charles X	5.0	6	1654–1660
Charles XI	4.0	25	1672–1697
11 Charles XII	19.0	21	1697–1718
Gustavus III	2.0	21	1771–1792
Charles XIV	0	26	1818–1844
	61.5	173	
Turkey:			
30 Mohammed II	30.0	30	1451–1481
4 Selim I	7.0	8	1512–1520
5 Suleimani	36.5	46	1520–1566
Murad IV	17.0	17	1623–1640
Mahmud II	16.5	31	1808–1839
	107.0	132	

average number of years of war per century, as revealed by the tables in "Is War Diminishing?" which is 48.5. But if we consider only the 30 leading autocrats, we find that the average rises to 57.5 war-years per century, or 565.5 out of 983. For the leading 20 the average is 54.2, and for the ten greatest the average is 63.4 years of war per century. The totals here are 212.5 years out of 335. These figures are large enough to be significant. Here is shown a rise of roughly 50% for the most autocratic periods as against the comparatively non-autocratic periods, of which there are about 300, and whose war record must have been a little less than 48.5 years per century.

The true correlation between autocrats and war must be somewhat higher than is here indicated, since oftimes democratic nations have been unwillingly drawn into conflicts against autocracy, as was the case in the Napoleonic period and in the late World War. In this way non-autocratic periods must get more years of war than would have been the case if all countries had always been free from great autocrats.

WAR-YEARS UNDER DEMOCRACIES

If we turn to the other side of the question and study the democracies themselves, it appears that their periods occupied in warfare have been somewhat less in total duration than the average. There have not been many eras of real democracy in European history, but there have been times when nations have been more democratic than at other times. England has, for instance, been largely governed by the voice of the people during recent

generations. The same is true of many European nations during the nineteenth century. It is this century, and especially its last half, that shows the maximum years of peace.

If we take out for study all periods in which no monarch or regent is recognized as ruling and the nation is theoretically a "republic," "commonwealth," "consulate," or designated by some such word, we have a definite criterion for inclusion and can express our results numerically.

If we omit the doubtful "stadholdership" in Holland, we have in England the Commonwealth, 1649-1660, with 10 years of war out of 11. France had three republics and one consulate with 21 years of war out of 63. Holland had two republics (1759-1766 and 1795-1805) and The States which lasted from 1702 to 1747. During these eras it showed 35 war-years out of 84. Spain had two years of republic from 1873-1875. They were filled with internal warfare. Russia, since the overthrow of the Czar, has been in an almost constant state of either warfare or anarchy.

The total of all these years of democratic control is 163. The total years of war are 72. This is 44.2%. It is somewhat less than the total for all autocratic regimes, which was 51.4%. It is considerably less than the average for the first ten which was found to be 63.4. Furthermore, in the instances where the democratic forms of government have been associated with an extremely high percentage of warfare, these popular governments represent beginnings in this practice of political control. Also England during "The Commonwealth," with 10 years of war out of 11, was in reality under one of the greatest of autocrats, though a non-royal one.

There is some additional argument that democracies may be associated with an increased amount of peace from the fact that the comparatively democratic nations, Denmark, Switzerland, Sweden, and Holland, have been free from war during the last hundred years.

It has not been possible to include in this research non-royal autocrats like Cromwell and Richelieu. The difficulty would be in knowing when to stop, since no comprehensive list of such statesmen has ever been formulated. But the logical conclusion is that, if royal autocrats predispose towards belligerency, non-royal ones also do, and therefore some of the fighting periods now credited to comparatively non-autocratic governments should in reality be taken as exhibiting a further proof of the truth of the theory here set forth.

AUTOCRATS DIFFICULT TO ABOLISH

There seems, then, to be no doubt that great autocrats are associated with wars probably as a contributory cause. If they are a cause of war, the question then becomes one of vital interest: How are they forever to be abolished? This is not likely to be an easy matter. Autocrats work insidiously and, until they have become strong, they are not autocrats. By the time they have become autocrats they are then strong, and consequently difficult to deal with. There is much that is permanent in human nature that makes easy the development of autocratic sway. Man is a very exploitable animal, and it is a long time before he realizes that he is being made into a machine. By the time he has been made into a machine and is part of a greater machine—that is, precisely what he is then willing to be or indeed wishes to be—so who is to stop the process? It is only the outside and outlying nations that can do this by uniting for the common cause. This they do over and over again, and the force of numbers wins for a time until again in some unsuspected quarter another autocrat has welded together another machine.

False and weak autocracies, like that of George III, Louis XVI, and Nicholas II, may break from within, but the genuine and strong, such as are under the personal control of some one great leader, require outside interference, which only becomes united after the autocracy has indeed been formed.

All this may be in some measure explanatory or not; at any rate the fact is that, while European history has shown for the last eight centuries a tendency for autocrats to become less numerous, it has not shown the same tendency towards a disappearance of autocrats of the first magnitude, those whom we find especially predisposing towards war.

In the history of England and France autocrats can be studied from the eleventh century onward. These are countries that have developed democratic institutions. Let us see if there is evidence of a gradual decline in the numbers of autocratic sovereigns throughout the centuries. Adding the numbers from both these countries together, we get the series from the year 1000 to the year 1900 by centuries as follows: 2, 4, 4, 2, 3, 4, 2, 0, 2; that is, there were two autocrats in the eleventh century, four in the twelfth, etc. It can be seen that the left-hand half of this series is heavier than the right. The ratio of weight is 13.5 to 9.5. Here we have numerical proof that autocracy has declined in France and England. This is significant as far as it goes, though the numbers are small.

If, on the other hand, we turn to Russia, Prussia, and Austria, we do not find the same tendency towards a decline in the number of autocrats. Figures for the early history of these countries are not available, but the records from the beginning of the fifteenth century are complete. The totals for each century are, according to our chart, 4, 2, 3, 5, 5. In these countries, then, just the opposite has taken place from what occurred in England and France. The right-hand, or modern portion of this series, weighs against the left in the ratio of 11.5 to 7.5. Are these figures significant? They are quite as likely to be as the reverse figures, 13.5 to 9.5, which suggested a decline in autocracy in France and England.

Both numbers are necessarily small, as we are dealing with a matter where only a few examples can be cited; but the figures warn us against assuming that democratic tendencies are constant in their growth or that they are part of the development of modern civilization. Here are three great nations whose territories cover a large portion of Europe, whose vast populations, if judged by their achievements, have unquestionably, at least until recently, advanced, both intellectually and materially, since the beginning of the fifteenth century, yet autocratic governance has actually been growing.

An answer, much more definite than this, to the whole question of the magnitude and distribution of autocracies in European history is gained by an appeal to all available instances from the eleventh century onward. A table containing such statistics is here given (see Table II). It shows two facts clearly. First, that as far as *all* autocrats are concerned there has been, in recent centuries, a decline in their numbers, and, second, it shows that, as far as the greatest autocrats are concerned, the reverse process was in operation up to about the year 1600. Since that date, all autocrats, both great and small, have been losing ground. The figures form such a regular series that little doubt is left as to their significance. Compare the earlier and the later halves of the table. If the totals for the 100 greatest autocrats be considered, the four centuries and a half prior to the year 1450 furnish, as compared with the subsequent 450 years, autocrats in the ratio of 190.7 to 96.4, or practically twice as many. From this the ratios change in an almost perfect gradation. For the first 50 autocrats the ratios virtually balance, being 63.5 to 62.8. For the first 40 we find more in the latter than in the earlier period. The ratios are 55.1 to 40.8. These rise for the first 30, being 44.4 to 26.3, sink for the first 20, though they exceed the first 40, and in final confirmation we find the highest ratio for the first 10 or greatest autocrats still on the same side of the balance, being 15.9 to 8.6 in favor of the late period or right-hand half of the chart. In other words, compared with the 450 preceding years, the last 450 have produced nearly twice

TABLE II.—*Distribution of Royal Autocrats by Centuries.*

	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
1st 10	1	0	0	0	1	4	1	2	1	
2d 10	0	0	2	0	2	3	1	2	0	
3d 10	0	0	1	0	1	4	2	1	1	
4th 10	0	1	0	3	1	0	1	1	3	
5th 10	0	1	2	2	2	1	0	1	1	
6th 10	1	1	0	2	2	0	4	0	0	
7th 10	0	2	0	2	1	1	2	0	2	
8th 10	1	0	2	1	5	0	1	0	0	
9th 10	0	1	1	5	1	2	0	0	0	
10th 10	1	3	2	1	2	0	0	0	1	
1st 100	4	9	10	16	18	15	12	7	9	

PERCENTAGES OF AUTOCRATS AMONG ALL ROYAL RULERS

1st 10	7.7	0.0	0.0	0.0	1.8	7.0	1.9	4.1	2
1st 20	7.7	0.0	10.0	0.0	5.4	12.3	3.6	8.2	2
1st 30	7.7	0.0	15.0	0.0	7.1	19.3	7.3	10.2	4
1st 40	7.7	5.9	15.0	7.7	8.9	19.3	9.1	12.2	10
1st 50	7.7	11.7	25.0	12.8	12.5	21 1	9.1	14.3	12
1st 100	30.8	52.9	50.0	41.0	32.1	26.3	21.8	14.3	18

as many autocrats of the first magnitude.

These are distinctively the autocrats who are associated with warfare, and so we see one reason perhaps why in recent centuries so much fighting has taken place. In our work, "Is War Diminishing?" the conclusion reached by Mr. Baltzby and myself was that there is proof for a decline in the number of war years in the last two centuries, but that the evidence was not sufficient for a sound generalization. That was for two reasons: First, because there was an increase from 1450 to 1600 and second, because the history of France and England, the only history that furnished data extending well into the past, did not sanction such a generalization. There was no general or constant decline in war-years. The first four centuries showed no more war-years than the second.

GRADUAL ELIMINATION OF AUTOCRACIES

Although there has been no constant or gradual disappearance of war-years or of great autocrats as might be the case if these two dreaded things were being exterminated by the enlightening processes of education and civilization, there is nevertheless a way of looking at all the facts that presents an outlook not necessarily gloomy. The whole matter in a nutshell is this: There occurred during these nine hundred years one gigantic wave which reached its peak in the sixteenth century. The wave of autocracy corresponded with the wave of war, probably entirely, though a fragment of one of the curves is lacking or incomplete. We have no data for any early war periods (prior to 1450) except for France and England, but the probability is that the other nations were not excessively engaged in war during the twelfth, thirteenth and fourteenth centuries. This is suggested from the fact that, although small autocrats were numerous in these various countries, very great autocrats were not, and furthermore it is known that the war-years in these countries increased from 1,450 to 1,600. Also the high average of French and English war-years culminated in the sixteenth century.

Since this period, the downward slope of the wave has been marked for all degrees of autocracy. The reason why the second 450 years shows more autocrats of the greatest magnitude is because the sixteenth century falls in the second or modern portion. If we compare the last two centuries with the two preceding, we find the ratio-weights all heavier for the earlier period, as shown in the table 8.9 to 6.1; 15.9 to 10.2; 26.6 to 14.2, and 28.4 to 22.2, as we descend from the ten greatest to the forty greatest of the dictators. This is substantiated by a comparison of the three recent centuries with the three preceding, for again, the ratios are without exception heavier for the earlier period: 8.8 to 8; 17.7 to 13.8; 26.4 to 21.5; 35.9 to 31.3. Comparing these two sets of ratios, the conclusion is warranted that it is especially during the last two centuries that the decline in autocrats is noteworthy.

These figures are much too consistent not to mean something very definite. Regard also the percentages for the distribution of all autocrats from the eleventh century to the nineteenth. Omitting fractions, these percentages run: 30, 52, 50, 41, 32, 26, 21, 14, 18. From the twelfth century onward each figure is smaller than the one before, with a slight exception in that for the nineteenth century.

Autocrats were proportionately most numerous in the twelfth and thirteenth centuries. Great autocrats reached the acme of their power in the sixteenth, as did also the gods of war. Perhaps it all may mean that we are at the bottom of a wave that will rise again, but if the records of recent generations are an indication of forces that are destined to be continuous, then in a few generations to come, at least one of the concomitants of war, the great monarchical autocrats, will have ceased to function on this planet.

New Eugenics Society in Hungary

The Hungarian Commission for Race-Hygiene, founded in February, 1914, was reorganized in 1917 as the Hungarian Eugenics Society and is now publishing a bi-monthly journal called *Nemsetvédelem* (Protection of the Race). A communication from its acting vice-president, Dr. Geza von Hoffmann, formerly Austro-Hungarian consul in Berlin and at one time a resident of the United States, tells of the growing eugenic movement in Hungary. He states that the Hungarian government has been carrying on an active campaign for the increase of eugenic knowledge by means of pamphlets, posters, placards, and popular lectures, both in civilian centers and in military establishments.

"Much stress is laid upon the positive side of the question," he observes, "*i. e.*, the propagation of the fit, and no steps have yet been taken to cut off the propagation of the unfit."

THE SPREAD OF ROSEN RYE[1]

FRANK A. SPRAGG

Michigan Experiment Station, East Lansing

IN 1909, the Michigan Agricultural College received a sample of pedigreed rye from Russia. Since the Russian name of this rye was unknown, it was called Rosen rye, after J. A. Rosen, who sent it. Mr. Rosen was a Russian student who graduated from the Agricultural College in 1908.

This sample was selected and tested by the Michigan Experiment Station, and 6 bushels of it were distributed in 1912. As it was generally planted alongside of the common rye, only the offspring of one of these bushels could be continued as pedigreed rye, and this bushel was sent to Jackson County, Michigan. It was planted on an acre and yielded thirty-five bushels in 1913. Soon the whole countryside around Parma (in western Jackson County) and around Albion, in eastern Calhoun County, grew Rosen rye as a winter crop, and little or no wheat. Other counties took it up and, with the aid of an active county agricultural agent, the new rye spread rapidly. St. Joseph County early became a prosperous Rosen rye center, having 3,500 acres in 1917, while Jackson County had 2,000 acres, the whole state having about 15,000.

It seemed to take three or four years for this new rye to attract the notice and the confidence that was needed for rapid advance. Since 1916, however, its spread in Michigan has been almost phenomenal. This has been due chiefly to the intrinsic merit of the grain, combined with the aid of the Michigan Crop Improvement Association in maintaining the quality and purity of the seed produced.

Field inspection began in 1917 under the leadership of the association's secretary, Mr. J. W. Nicolson, East Lansing, Mich., and certified grain began to be sold to the farmers of other states as well as to Michigan farmers. As the result of this activity in wartime, when farmers were being urged to sow the best seed, approximately 250,000 acres of Rosen rye were sown in Michigan in the fall of 1917. The trade also began to take notice of the new rye. It was quoted on the Detroit market that year, and carload lots began to be available for other states as well as in Michigan.

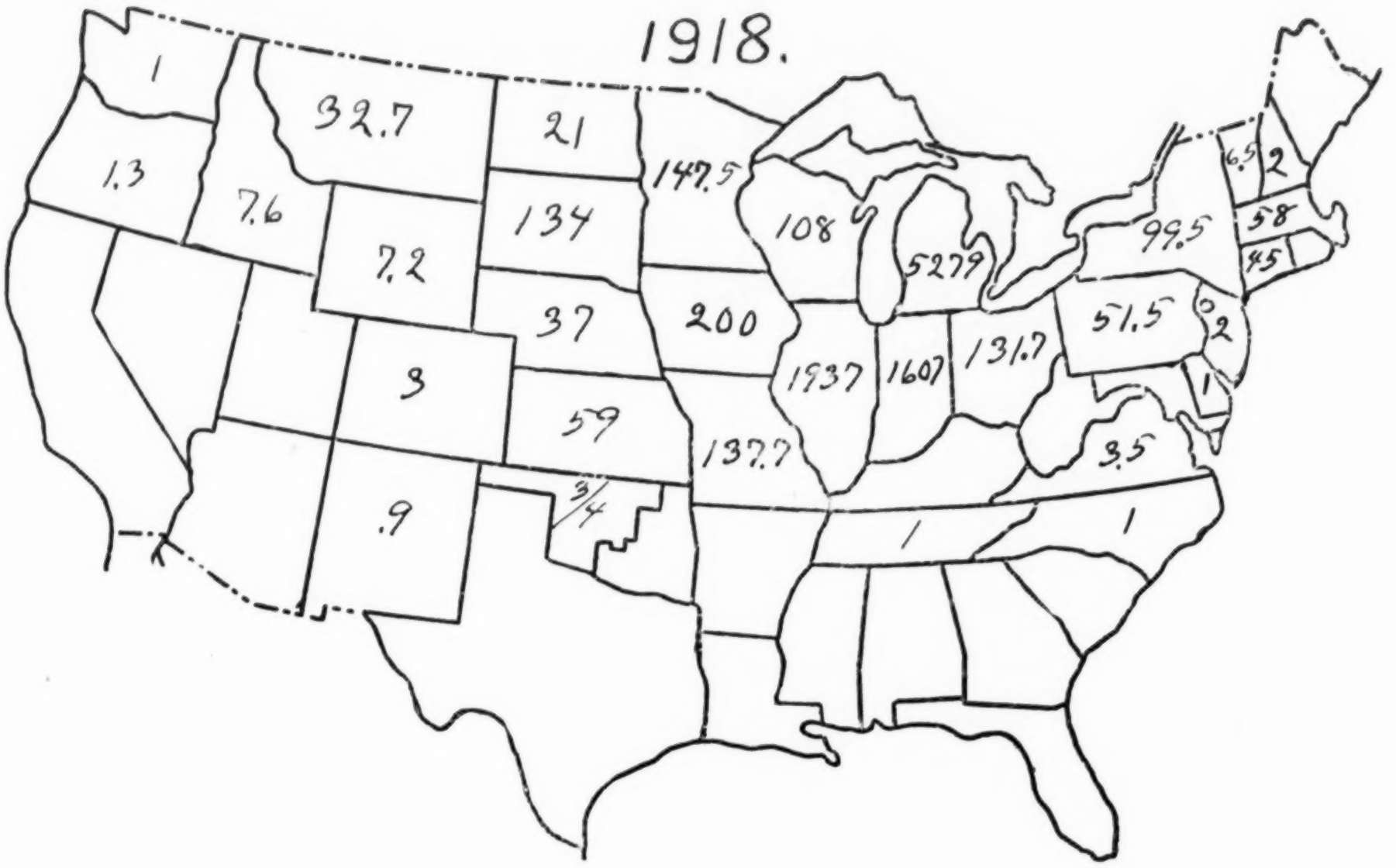
HIGH YIELD AND INCREASED ACREAGE

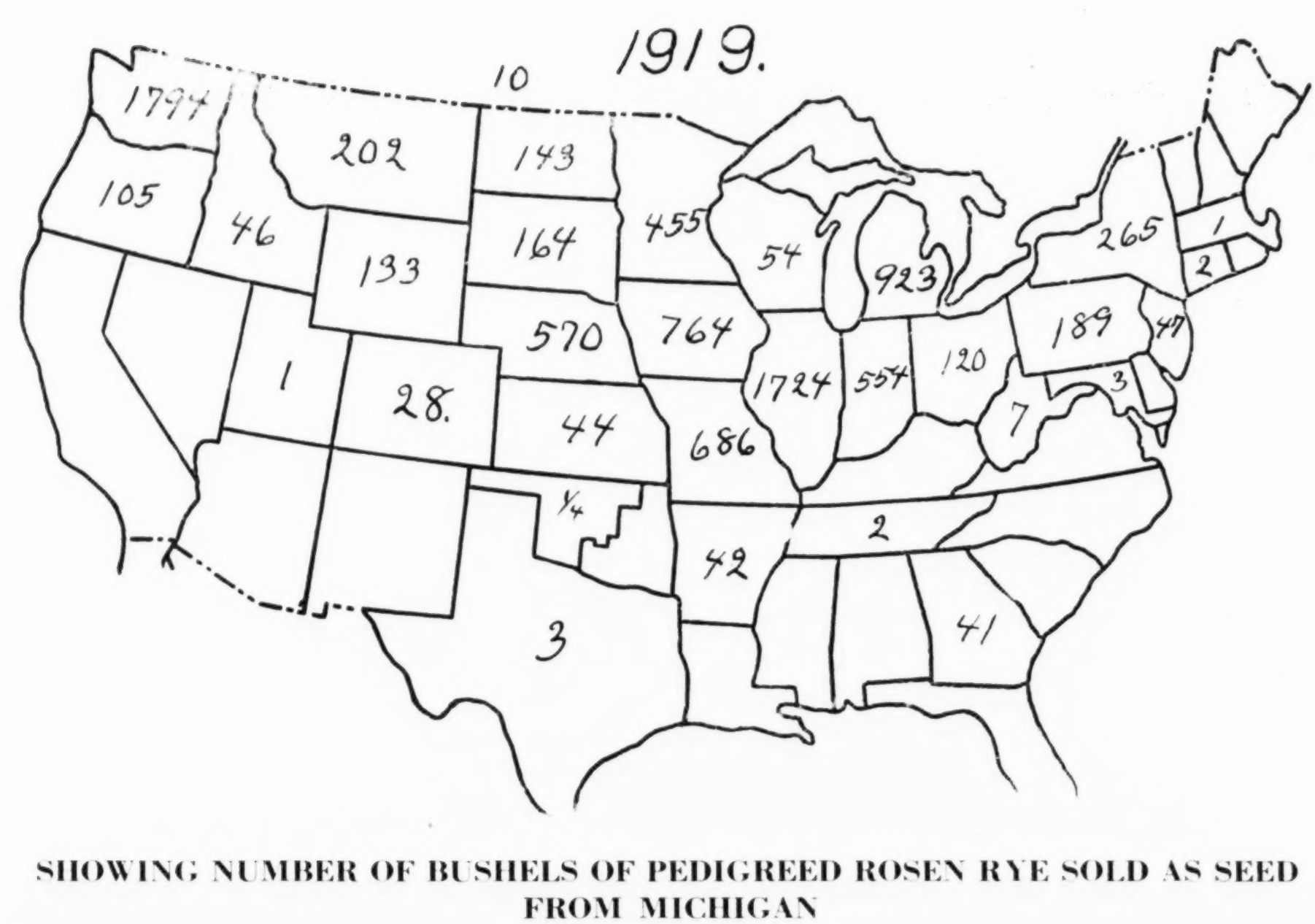
The inspectors of the Michigan Crop Improvement Association began work again in June, 1918, and during the following month passed about 1,000 acres. This acreage produced 22,349 bushels, a good yield when it is remembered that most of it grew on sandy soil, and that a yield of 15 bushels per acre was considered a high return before the Rosen rye was introduced. Again, under the stress of war conditions, the acreage was almost doubled in one year, as considerably over 400,000 acres in Michigan were sown to Rosen rye in the fall of 1918.

Growing Rosen rye in Michigan is now so general that even the common rye is mixed with it. It is now difficult to find the old-fashioned common rye for class purposes, and the college may soon be compelled to grow common rye as a curiosity. About 85% of the rye acreage of Michigan is more or less pure Rosen. Of this, less than 1.5% is pedigreed. Much of it is nearly as good as the pedigreed, but lost to record under the association.

The growing of Rosen rye in other states began commercially as early as there was a supply. It has gone from

[1] A detailed account of Rosen rye by Mr. Spragg appeared in the JOURNAL OF HEREDITY for December, 1918 (Vol. ix, No. 8).—ED.





SHOWING NUMBER OF BUSHELS OF PEDIGREED ROSEN RYE SOLD AS SEED FROM MICHIGAN

The upper map indicates the number of bushels sold in 1918, and the lower map shows the figures for 1919. First introduced in Michigan in 1909, this rye had its first extension into other states in 1917. The rapid advance from 1918 indicates that its superiority over the common rye is quickly recognized. (Fig. 19.)

farm to farm across the state line into Indiana and Ohio, until the upper two rows of counties in Indiana have as much Rosen rye as the southern row of counties in Michigan. When carloads began to be available in 1917, the trade grew rapidly, increasing steadily since that year, and now several elevators and seed firms in Michigan count their sales of Rosen rye for seed in dozens of carloads. Much of this seed is purchased in sections where the rye is resonably pure, but, unfortunately, comparatively few people seem to realize the fact that rye cross-fertilizes. A great deal of rye that is now sold as Rosen is very badly mixed. The results obtained with this commercial seed are frequently not equal to those obtained by the use of seed inspected in the field and bin by the Michigan Crop Improvement Association, which coöperates with the College in maintaining very high standards of purity.

ALREADY COMMERCIALLY IMPORTANT

The extension of pedigree Rosen rye into other states began in 1917, when the inspection work began, but the sales made by the members of the association were imperfectly reported that year. For that reason exact figures are unobtainable. However, a fair proportion of these sales have been reported in 1918 and 1919. One outline map, Fig. 19, shows the sales by states in 1918, and another shows the corresponding figures for 1919 as far as they are reported to date. But, as indicated above, this is a very small portion of the seed sold as Rosen, as the commercial trade has assumed vast proportions. The pedigreed seed, however, is the only seed of guaranteed purity, and is therefore the basis upon which this or other states must base opinion regarding the value of Rosen rye.

The figures on the two maps should be carefully studied. so as not to be misinterpreted. In 1918 Illinois and Indiana were the largest purchasers of pedigreed Rosen rye outside of Michigan yet it is probable that Michigan bought more pedigreed Rosen seed than all other states combined. In 1919, Michigan farmers bought less pedigreed Rosen seed than certain other states. The State of Washington, bought almost twice as much pedigreed Rosen seed as Michigan itself did. To explain these facts one must remember that pedigreed or high-grade Rosen is quite generally in the hands of Michigan farmers. They are simply planting their own seed. It is only the few who wish to replace their mixed seed with the pedigreed that are now buying the pedigreed seed in Michigan.

Several states have obtained pedigreed seed for two previous years and should be growing quantities of pure Rosen rye, but we have no record at present. A report comes from Minnesota, where a man purchased the pedigreed Rosen seed from Michigan in 1918 and sold 3,000 bushels for seed in 1919. Others can do likewise. It is the more distant states, where a smaller supply is available, that are purchasing increased amounts.

A Genetic Association in Italy

Leading Italian men of science have united in the "Italian Society of Genetics and Eugenics," whose object is "to promote and support all researches and movements tending to increasing knowledge of the laws of heredity and the improvement of races, with special regard to the human race."

Dr. Ernest Pestalozza is president of the organization and Dr. Caesar Artom secretary. The headquarters are at the Municipal Zoological Garden, Villa Umberto I, Rome.

Control of the society is placed by the by-laws in the hands of fifteen delegates, to be chosen equally from the biological, medical and social sciences.

One of the society's first efforts is to prevent racial hybridization. It has sent out a letter to various organizations such as the American Genetic Association, which reads:

"The directing council of the Italian Society of Genetics and Eugenics has adopted the following proposal of Professor Dr. V. Giuffrida-Ruggieri, professor of anthropology in the Royal University at Naples.

" 'With the victorious termination of the world war, the powers of the entente find themselves more closely than in the past, in contact with the African world. It would therefore be opportune for the various eugenic societies to coöperate by bringing to the attention of the governments of their respective countries the desirability, where it has not already been done, of securing legislation to prevent marriage between Europeans and members of the African races. Marriage should be permitted only with Africans of the Mediterranean race (Berbers, Egyptians) and Arabs who are not negroes. Such a prohibition ought to extend to all the half-breed populations scattered over the African continent.'

"The intention of the proposal would be to prevent the increase of a mixed European-African race, which appears to be undesirable from various points of view."

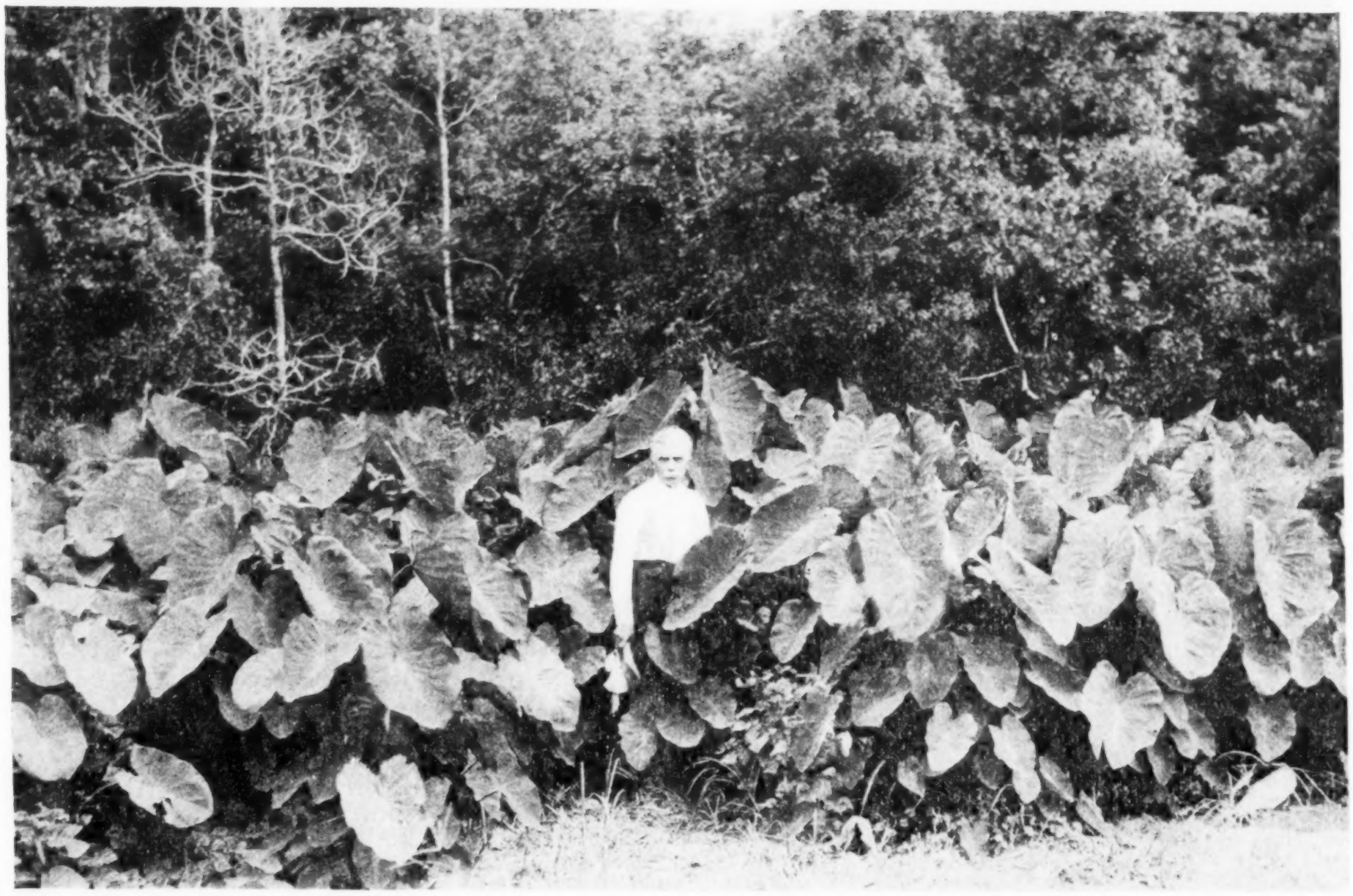
The Intelligence of the Negro

Applying a group scale of intelligence to the colored school children in two small Indiana cities, S. L. Pressey and G. F. Teter conclude that they show less intelligence than white children in the same cities. Their study is published in the *Journal of Applied Psychology*, Sept., 1919.

Reviewing previous work in this field, the writers say: "Colored school children show a greater school retardation, less acceleration, and average older for a given grade, than do white children. There is some evidence to show that, grade for grade, they do poorer school work. Negro children give ratings, when tested by the Binet and Point scales, averaging below white children. Measurements of special abilities have shown the colored children to do well in tests of the more simple processes (as cancellation, rote memory) and most poorly with tests of the more complex abilities (as opposites, analogies, sentence completion). There is some evidence that colored children have more active imaginations and more ready associations of an uncontrolled type than do white children."

Discussing their own results, the writers point out that among the colored children "a poor average ability seems unmistakably indicated," which not only leads the colored children to be retarded in school, as compared with whites of the same age, but leads them even in the retarded classes to do poorer work than whites in the same classes.

Is this not perhaps due to some special defect, rather than to general inferiority? Apparently not; "the colored children show poorer ability than the whites on every test." There is the definite suggestion "of a more elementary and less highly developed ability among colored children"; but the writers believe "that the important racial difference may be, after all, emotional and temperamental."



VIEW OF FIELD OF DASHEENS IN FLORIDA

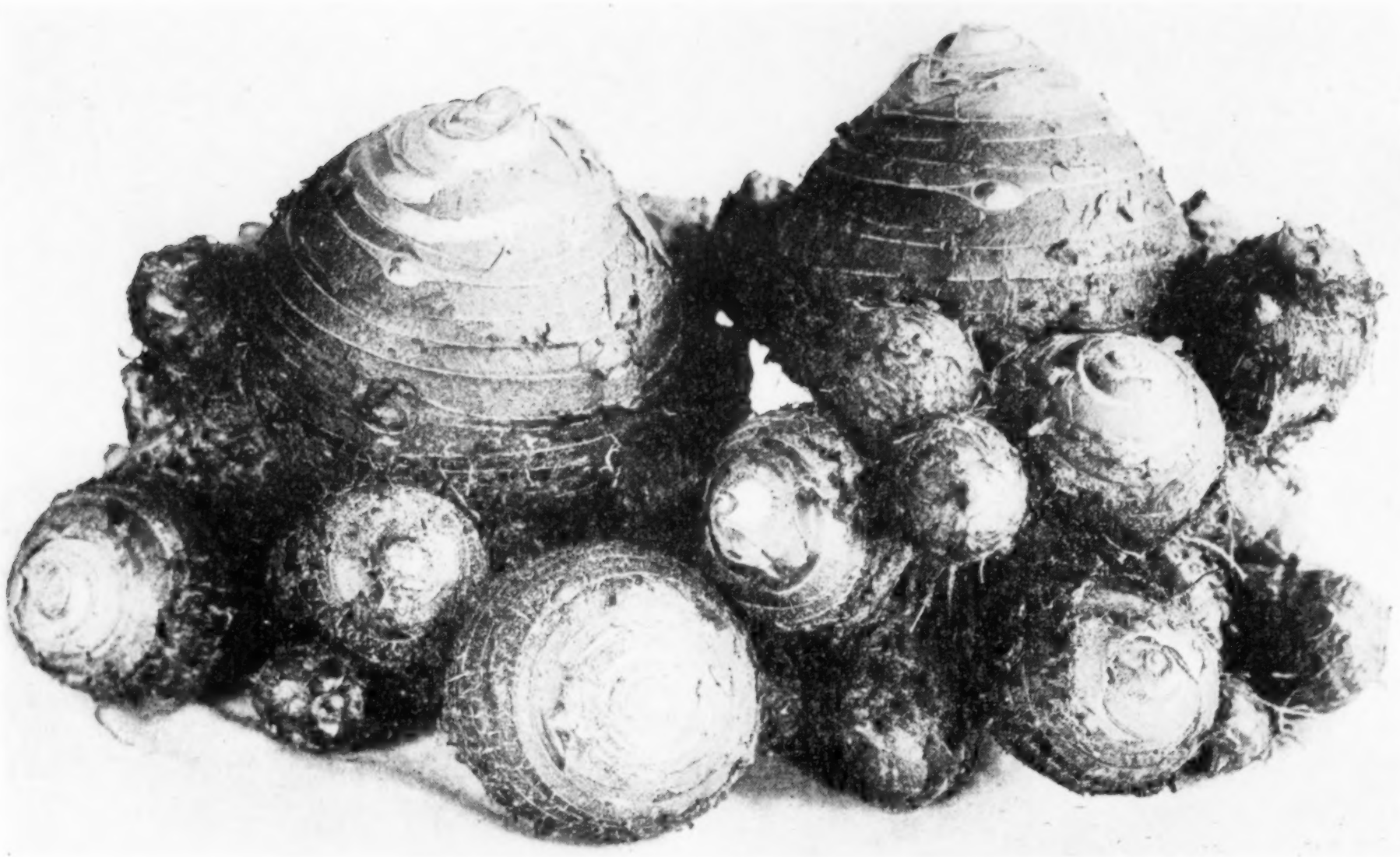
"We have acquired the taste for the dasheen, and it is a part of our regular food: to use the expression, we seem to flourish on it." This is the statement of John F. Groene, formerly Justice of the Peace at Tarpon Springs, Fla., who stands among his plants in the photograph. He became so fond of dasheens that on moving to California, he began at once to encourage experimentation with their cultivation there. (Fig. 20.)

Pioneer Growers of the Dasheen

In the introduction of a new vegetable into cultivation, there comes a time when those pioneers, who believe sufficiently in its future, to risk their own labor, land and money in its production, need encouragement. They need to be helped in popularizing the vegetable, and in getting their product before a public that believes in trying new foods.

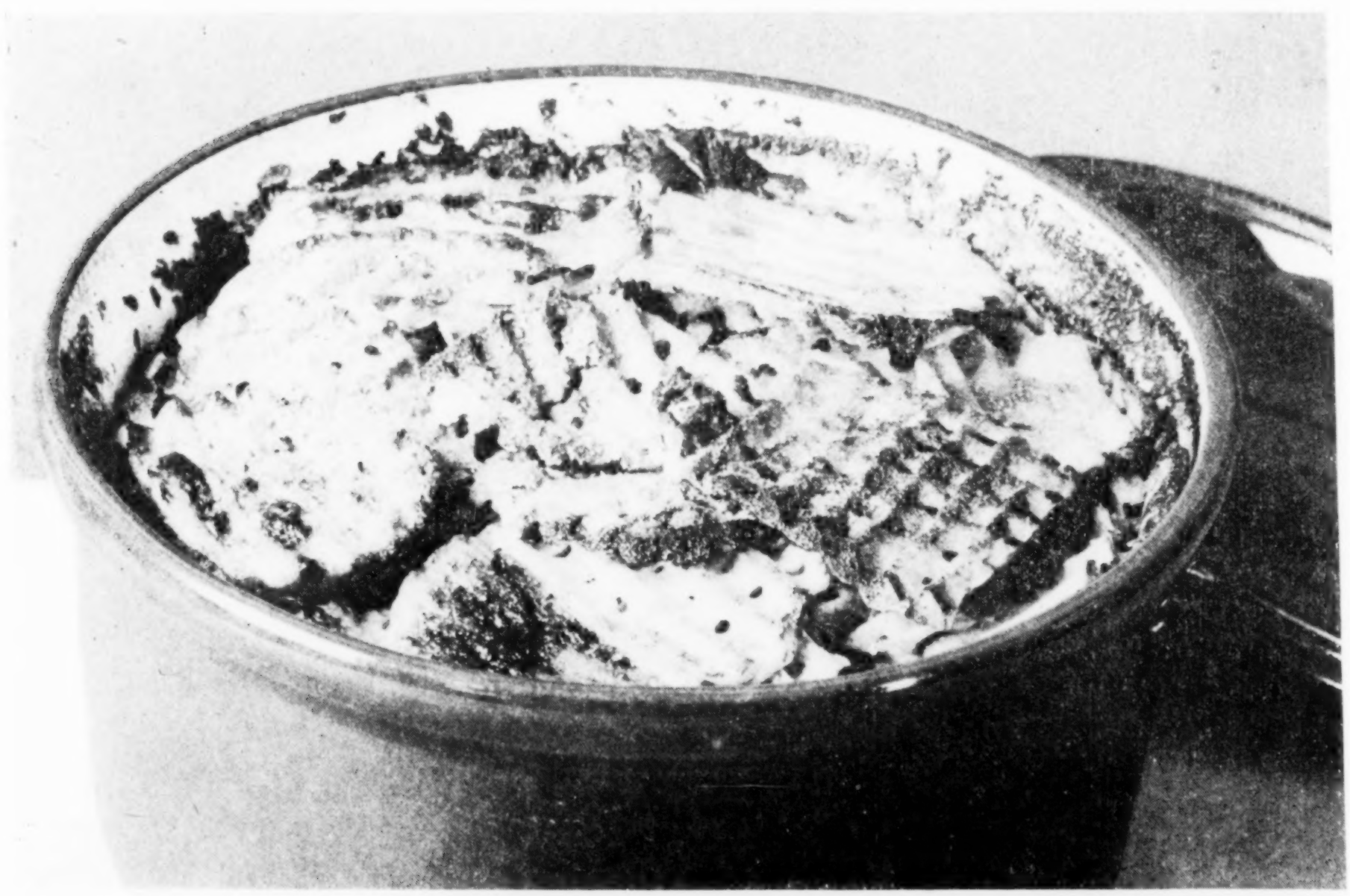
The dasheen is one of these new foods. It is now being grown as a crop quite generally in the South Atlantic and Gulf States, but mostly in Florida. It is sold by fancy vegetable dealers in many southern and northern cities, and the production heretofore has scarcely kept pace with the growing demand. This season, for the first time, there is opportunity for householders to purchase dasheens direct from growers, or their agents, in the south. Shipments of one bushel or more will be made—preferably by express on account of the danger of delay and freezing if sent by freight. To eastern cities having direct steamer connection with the south, barrel shipments can be safely forwarded by steamer freight.

Following is a list of three growers, and one representative of a number of growers on Lake Okeechobee, with whom any interested persons may communicate. Letters to these men should specify quantity desired, and ask for the price: W. E. Clark (grower), Torry Island, Fla., Fellsmere Co., (grower), Fellsmere, Fla., J. H. Freeman (representative), Ft. Lauderdale, Fla., W. C. Greer, (grower) Torry Island, Fla.



A HILL OF DASHEENS WEIGHING ELEVEN POUNDS

Each hill of dasheens yields one or more large corms, like the two shown above, and a number of cormels, or lateral "tubers;" all are edible. The corms are especially delicious when baked and eaten immediately upon being taken from the oven. (Fig. 21.)



DASHEEN EN CASSEROLE

This is one of the many delicious dishes made from the dasheen. The vegetable is prepared, with slight modification, in all the ways in which potatoes are used, and some besides. It makes an especially excellent filling for fowl. (Fig. 22.)

A NEW DAHLIA OF INTEREST TO PLANT BREEDERS

W. E. SAFFORD, of the Bureau of Plant Industry, has published in a recent issue of the *Journal of the Washington Academy of Sciences* (July 19, 1919), descriptions of two new dahlias from Guatemala, one of which, *D. popenovii*, should be of more than ordinary interest to plant breeders who are working with this genus. According to Mr. Safford, this species is probably an ancestor of the cactus-flowered dahlias, a group derived from *Dahlia juarezii*. The latter species is a hybrid, supposed to have originated naturally in Central America through the crossing of *D. popenovii* and some other species.

Mr. Safford, who is at work on a revision of the cultivated dahlias with a view to determining their botanical relationships, writes:

"In nearly all the monographs on the genus Dahlia hitherto published, the different varieties have been grouped from the horticulturalist's point of view, according to the forms of the flowers, under such headings as 'single, duplex, anemone-flowered, collarette, pompon, fancy, decorative, peony-flowered, and cactus dahlias,' without identifying the single-flowered forms with botanical species (except perhaps in *Dahlia coccinea* and *Dahlia imperialis*) or attempting to connect the 'duplex' and double forms with their primitive single ancestors. It is very probable that the types upon which several species have been based were hybrid plants. *Dahlia pinnata* itself, the type of the genus, was probably a hybrid. In the Index Kewensis its name is discarded as a synonym for the subsequently described *D. variabilis*. In the same way the handsome *Dahlia juarezii* with large double heads composed of strap-shaped florets having their edges turning backward, in sharp distinction to the involute or quilled floets of the artificial-looking 'pompon dahlias' and the broad, flat-rayed heads of the 'century' type of modern catalogues, is also to be regarded as a hybrid. Dahlias with flowers identical in form with the type of *Dahlia juarezii*, the ancestor from which the 'cactus dahlias' of our gardens have sprung, are no longer called 'cactus dahlias' by specialists, but 'cactus hybrids.' One of the ancestors of *Dahlia juarezii* must have been a single-flowered species, with eight revolute ray-florets. Such a plant has recently been discovered in the mountains of Guatemala."

Mr. Safford describes this species, *D. popenovii*, as a plant about one meter high, with slender, purplish stems, the leaves simply pinnate (except perhaps the lower ones), and the flower-heads about 3 inches broad with eight slender, revolute ray florets, bright scarlet or cardinal in color. It differs from the closely allied *Dahlia coccinea* in the shape of the ray florets and the scales, and in the character of its leaves.

This new dahlia is being propagated by the Office of the Foreign Seed and Plant Introduction of the Bureau of Plant Industry, by which it was introduced from Guatemela.